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(54) 【発明の名称】フルカラー画像形成方法

【57】【要約】

【課題】 高画質なフルカラー画像を高速かつ安価で提供できるフルカラー画像形成方法を提供すること。

**【解決手段】** 現像剤としてマゼンタトナーを含むマゼンタ現像剤、シアントトナーを含むシア現像剤、イエロー現像剤、シアントトナーを含むイエロー現像剤、およびブラックトナー、およびブラック現像剤を用い、各トナーが体積平均粒径100nm以下、 $0.5\mu\text{m}$ を有しながら、少なくともバインダー樹脂部、重量平均分子量1000~3000および重量平均分子量10000~20000、数平均分子量2000以下の重合物 (B) 1~20重量部および着色剤を含んでなり、マゼンタトナー、シアントトナー、およびイエロートナーの被覆成分に対する最大付着量それぞれが $5.0\text{g}/\text{m}^2$ 以下の値に制御することを特徴とするフルカラー画像形成方法。

## 【特別編集】矢野龍渓の「田舎」

**【特許事項1】** 静電潜像担持体上に潜像を形成し、該潜像を現像剤で現像する工程、および静電潜像担持体上に被覆されたトナー像を介して中間転写体を介しては介さず、被覆被膜材上に転写する工程を、現像剤の色ごとに繰り返す工程とを有し、被覆被膜材上に転写したトナー像を定義する工程とを有するフルカラー画像形成方法であって、被覆被膜材としてマゼンタトナーを含むマゼンタ現像剤、シアントナーを含むシアン現像剤、イエロートナーを含むイエロー現像剤、およびブラックトナーを含むブラック現像剤を用い、

また、ナトリウムが体質量の約3~7.5%を有しながら、少なすぎない。また、バイリンダー樹脂(100重量部、重塩平均分子量1000~3000)および重塩量塩および着色剤をそれぞれ2.0以下の重量部(8)1~20重量部を含有する混合物を、セメントナー、シアントナーおよびエレクトナーのいずれの一種の樹脂材料に対する最大付着量をそれぞれ5.0、0.6、0.2以下に制御することによって、

【請求項2】 マゼンタトナー、シアントナーおよびイエロートナーの被記録材に対する最大付着量を $5.0\text{g}/\text{m}^2$ 以下の同一の値に制御することを特徴とする請求項1に記載のフルカラー画像形成方法。

【請求項3】 重合体(B)が、芳香族モノマーおよび/または脂肪族モノマーの単独重合体または共重合体であり、また、脂肪族モノマーの単独重合体または共重合体である請求項または2に記載のフルカラー画像形成方法。

【請求項4】 バイナリー樹脂のガラス転移点が50～60℃である請求項1～3いずれかに記載のフルカラー画像形成方法。

【請求項5】 マゼンタトナー、シアントナーおよびイエロートナーの後処理剤の種類および量が略同一である請求項1~4いずれかに記載のフルカラー画像形成方法。

【發明の詳細な説明】

【0001】  
【発明の属する技術分野】 本発明はフルカラー画像形成方法に関する。

**【0002】**

従来の技術】フルカラー画像形成方法は一般に、静電複写機特有の感光性（感光）上に潜像を形成し、該潜像をトナーで現像する工程（現像工程）を経て複写機特有体上に形成されたトナー像を中間転写体上で介してまた介して搬送され、複写機特有体上に転写する工程（転写工程）、および被記録媒体上に転写したトナー像を定着する工程（定着工程）を含んでなる。詳しくは、マゼンタ色、イエロー色、シアン色およびブラック色の４色のトナーを用い、各色ごとに現像を繰り返すことによってトナー層を重ね合わせた後、加圧および加熱によってトナー層を定着する。このような画像形成方法により使用されるトナーは、少なくともバインダー成分と着色剤成分とを含む樹脂組成物から成るが、一般的にはより分級した樹脂組成物を必要とするため、粗粉および微粉状とに分けて供給される。

[0007]

**【0007】**

本發明において、高品質なフルカラー画像を生成するために、高品質なフルカラー画素を高品質なデータによって提供できるフルカラー像形成方法と提供する。

本発明においては後で詳述するような材料を含む。本発明においては後に記載するような特定の重合体(B)を用いたため、トナーは粒子表面に重合体(B)が露出した構造を有する。トナーがこのような構成を有するため、比較的多量の着色剤が充填されても、トナーの粒子表面に着色剤が露出する確率が低くなる。

低減され、個々の青色帯の帯電電位差の選いに基づく各色のトナー間における帯電レベルの差は低減されると考えられる。また、トナーが上記のように帯電を有するため、トナー濃集が起ることになり、この効果も得られ、形成方法を提供することとを目的とする。

**【要領を解決するための手段】**本発明は、静電機油俊保持  
**【0009】**

10 る。さらには重合体(B)を用いることによって、トナ  
 一の生産性が向上するという効果も得られる。

【0014】トナーの製造において重集合 (B) を用いると、混練工程においてバインダー樹脂中に重集合 (B) が粒子として分散され、粉砕工程で形成された粒子 (B) の分散粒子を結ぶように粉砕面が形成されながら粉砕されるため、粒子表面に重集合 (B) が露出しながら構成を有する、トナーが得られると考えられる。詳しくは、混練物中にはける重集合 (B) 粒子が存在するところでは、粉砕はバインダー樹脂と重集合 (B) 粒子との接触面 (界面) ではなく、重集合 (B) 粒子の内部を通して起るため、当該粉砕面は重集合 (B) によって構成され、結果として重集合 (B) は粒子表面に露出すると考えられる。

【0015】本発明において使用される重合体 (B) は、質量平均分子量 ( $M_w$ ) が1000〜3000、好ましくは1000〜2800、重量平均分子量/数平均分子量 ( $M_w/M_n$ ) が2.0以上の重合物であり、好ましくは1.9以下である。そのような重合物 (B) を用いないと、重合体 (B) が粒子表面に露出しない構成のトナーを得られず、各色のトナー間における帯電レベルの差が比較的大きくなり、トナーごとに最大付着量を比較的大きく変更する必要がある。現時点におけるトナー一ごとの条件が安定で煩雑と生じ、さらに、重合体 (B) の $M_w$ が1000未満であること、重合体 (B) のガラス転移点

【0011】  
【発明の実施の形態】本発明の方法に使用される現像剤は、トナーとキャリアとを混合して得られる成分現像剤であり、また、トナーを単独で用いる1成分現像剤であってもよい。また、本発明において現像剤が低くなるため、比較的高い温度でトナーを放置したとき、現像剤の保管性（耐熱保管性）が悪化し、実用上使用が困難となる。一方、 $M_n$ が3000を超えるとき、本発明自身の粉砕性が悪くなり、本発明を用いることによる粉砕性の向上効果が認められなくなる。

【0016】本明細書中、重合体または樹脂の組成および  
Mnはゲルパーミエーションクロマトグラフィー（GPC-IT  
型；日本分光工業社製）によって測定した値を用いて  
いる。詳しくは、カラムを40℃に保ち、キャリア溶媒と  
してテトラヒドロフランを10mg/cm<sup>3</sup>流し、測定する試  
料30mgをテトラヒドロフラン20mlに溶解させ、この溶液  
0.5mgを上記キャリア溶媒とともに導入して、ポリスチ  
レン換算により求めた。

トナーおよびブラックトナーはそれぞれ独立して以下

【0017】そのような重合体 (B) は粉砕性指数の、1〜

1.0、好ましくは0.2〜0.6を有することが望ましい。粉

砕性指数とは粉砕され易さを表すひとつの指標であり、

50 当数値が小さいほど粉砕され易いことを意味する。

【0013】本発明において使用されるトナーは少なく

とも、バインダー樹脂、特定重合体 (B) および着色剤

【0018】 本明細書中、粉砕性指数は以下に従って測定される。

粉砕性指数は、粉砕機を用いて、体積平均粒度(μm)程度の原料を規定された体積の粉砕機 (KTM-9型：川崎重工工業社製) で処理品F (5g/g) の、KTM 回転数 12000 (rpm) に粉砕する際に、その原料は、本試料と粉砕機が通無し時の負荷動力値と試料を通過させた時の負荷動力値(μm)を記録する。その後、KTM 粉砕で得られた粉砕材の体積平均粒度(μm)をコールタルチャイザ (型番 II (コールター・ベック・インスト) に測定する。得られた値から下式に基づいて粉砕性指数を算出する。

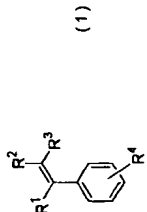
$$\text{粉砕性指数} = (D \times (W_1 - W_0)) / F$$

【0019】また、重合体(B)のガラス転移点(T<sub>g</sub>)は、重合体(A)のガラス転移点より好ましくは60〜80℃であることが望ましい。本明細書中、重合体Aは樹脂でガラス転移点は示差熱重量計(DSC-200;セイコー電子工業製)を用いて、リファレンスをアルミナとし、10mg/分、メイン吸熱ピークのショルダー直ぐラス転移点として、メイン吸熱ピークのショルダー直ぐラス転移点と定し、メイン吸熱ピークのショルダー直ぐラス転移点と定する。

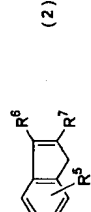
(B) 【0202】重合体(B)の種類としては、重合体(B)がバインダー樹脂と粉砕性金属とでも相溶せず、かつバインダー樹脂と粉砕性金属との限り、特に制限されず、例として、公知の芳香族ポリアマーおよび脂肪族ポリマーの単独重合体または共重合体を使用できる。ここで「バインダー樹脂」とは、粉砕性と相溶性が異なる、重合体(B)の粉砕性指数がバインダー樹脂の粉砕性指数より0.5以上、好ましくは1.0以上小さいことを意味する。そのように相溶性の関係に有する重合体(B)およびバインダー樹脂を用いたことにより、重合体(B)が表面に付着することを得ることができる。

【0021】芳香族モノマーとしては一般式(1)；

【作1】



(式中、 $R^1$ ,  $R^2$ ,  $R^3$  および  $R^4$  はそれぞれ独立して水素原子、ハロゲン原子、または炭素数1～4のアルキル基、エチル基、n-プロピル基、n-ブチル基、フェニル基、および、好ましくは水素原子、塩素原子、臭素原子、またはメチル基である)で表されるモノマーと、一般式(2):



(式中、 $R^5$ 、 $R^6$ および $R^7$ はそれぞれ独立して水素原子、

ハロゲン原子、または炭素数1~6のアルキル基、例えばメチル基、エチル基、*n*-プロピル基、*n*-ブチル基、*n*-ペンチル基、*n*-ヘキシル基であり、好ましくは水素原子、塩素原子、臭素原子、またはメチル基である)で表されるインデン系モノマーが挙げられる。

【0022】スチレン系モノマーの具体例としては、例えば、スチレン、ビニルトルエン、 $\alpha$ -メチルスチレン、イソプロピルビニルトルエン、 $\beta$ -メチルスチレン、1-プロピルビニルトルエン、 $\alpha$ -クロロスチレン、 $m$ -クロ-

ロスチレン、p-クロロスチレン、a-クロロスチレン、β-クロロスチレン、o-クロロスチレン、m-クロロスチレン、p-プロモンスチレン、a-プロモンスチレン、β-プロモンスチレン等が揃えられ、好ましくはスチレン、ビニルトルエン、α-メチルスチレン、イソプロピルトルエン、β-メチルスチレン、1-プロペニルトルエン、より好ましくはスチレン、ビニルトルエン、α-メチルスチレン、イソプロピルトルエン、さらに好ましくはスチレン、α-メチルスチレン、イソプロピルトルエンである。インデン系モノマーの具体例として

では、例えば、インデン、メチルインデン、エチルインデン等が挙げられ、これらの中でもインデンが特に好ましい。この場合、純度の高いビュモノマーを使用することが樹脂の着色、臭気、VOC量を低く抑える上で好ましい。芳香族モノマーには組み合わせて用いてもよい。

【0023】脂肪族モノマーの具体例としては、上記芳香族モノマーと重合可能であれば特に制限されず、例えば、イソブレン、ビニレン、1,3-ブタジエン、1,3-ペンタジエン、1,5-ヘキサジエン、2,3-ジメチル-1,3-ブタジエン、クロブレン、2-プロモ-1,3-ブタジエン等

[illegible]

ル、アクリル酸デシル、アクリル酸ウンデシル、アクリル酸ドデシル等のアクリル酸アルキルエステル系モノマー；メタクリル酸デシル、メタクリル酸ウンデシル、メタクリル酸ドデシル、メタクリル酸イソプロピル、メタクリル酸n-プロピル、メタクリル酸イソブチル、メタクリル酸n-ブチル、メタクリル酸イソペンチル、メタクリル酸n-ペンチル、メタクリル酸イソヘキシル、メタクリル酸n-ヘキシル、メタクリル酸3-(メチル)ブチル、メタクリル酸ヘキシル、メタクリル酸オクチル、メタクリル酸ノルマル、メタクリル酸ドデシル、メタクリル酸ウンデシル、メタクリル酸ドデシル等のメタクリル酸アルキルエステル系モノマー；





\* するように制御する。自動動電位制御を実行するときは、1 枚目の画像が出るまでに数十秒の待ち時間が発生するが、上記のような静電帯留相対的な表面電位の変動量に反比例して、比較的效果の小さい自動動電位制御は行われなくなり、結果として自動動電位制御の実行回数に反比例して減低されるため、作業電位が向上する。

【0060】別の好ましい態様においては、自動動電位制御を実行する際、前記の黒背景の色調に対する変動量に基づいて、複数の異なる色のトナーそれぞれについて、基準トナー像を形成して現像条件を決定する第1のモードと、基準トナー像を形成して、他のカラートナー画像を定義ローラー等によって転写し、転写されたフルカラー画像を定義ローラー等と同様にして行い、他のカラートナー画像を被覆材料に転写し、転写されたフルカラー画像の形成方法

10

【0050】各カラー画像の形成順序は変更しても特に問題はない。また、上記説明に於いては、構成材へ垂直方向に各カラートナー画像を順次転写する構成を示したが、中間転写ベルト等の中間転写体へ各カラートナー画像を一層ずつ転写して順次転写してもよい。また、各カラートナー画像を順次転写して重ね、重ね合わせた画像を一緒に転写してもよい。

【0057】本発明のフルカラー画像形成方法を実際に試行する必要なく、結果として自動露度制御の実行回数が増加することにより、作業能率が向上する。

【0058】本発明の方法においては、上記2つの好ま

しい懸球を組み合わせて採用することにより、作業効率はのさなる向上に回りながら、長期にわたって高画質なフルカラー画像を高速かつ安価で提供できる。

【0059】

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【0058】自動減速制御とは、所定の現象条件により、静電増倍像用トナー像（ベタトナー像）を形成する旨を取り付けたガラス製4つつねろフコに、表に示す寸法で付けたアルミニウム成分および硫黄成分を重合開始剤（ジブチル錫オキソキヤニド）とともに入れた。これをマンホールターナー中で窒素雰囲気下で、220℃で押付しつつ反応させて、ポリエステル樹脂（A）を付したを得た。得られたポリエステル樹脂は表に示す通りの物性を有する。

【0050】好ましい態様においては、上記自動電位制御を行う一方で、一定周期毎に、所定の条件で電位された静電電位を電流計付特殊の表面電位を測定手段により測定し、その測定電位に記憶せるとともに、該測定し、その測定手段に記憶手段に記憶値とを比較し、記憶手段に記憶値に記憶電位値とを比較する。

【0063】  
【表1】

前記自動濃度制御を実行せずに前回の現象条件を維持す\*

番号	主成分	成分			Mn	Mw/Mn	Tg (°C)	Tm (°C)	酸価 (KOHmg/g)	水酸価 (KOHmg/g)	粉砕性 指数	
		アクリル成分										
		PO	EO	FA								
A1	ポリアクリル樹脂	1.0	10.0	7.0	2.0	3500	3.6	55.4	98.0	4.8	29.1	2.2
A2	ポリアクリル樹脂	10.0	1.0	—	9.0	3900	3.8	64.5	100.2	3.8	27.4	1.8

【0064】(重合体(B)の製造)

スチレン（純度99.9%）150gおよびトルエン150gをオートクレーブに仕込み、密封下に温度を5℃に保ちながら、BとCの割合で添加した水溶液を加えて30分間激烈に攪拌して、ナトリウム水溶液50mlを加えて30分間激烈に攪拌して、水層を分離した後、水層を分離し、更に重合油を中材に

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なるまで水洗した後、未反応油および溶媒トルエンを留去し、残渣としてポリスチレン120 gを得た。当該ポリマーを樹脂B1とし、物性を表2に示した。

【0065】・精製2  
α-メチルステレン (純度99.8%) 150gおよびトルエン  
50gをオートクレーブに仕込み、槽下を5℃に保  
ちながらBF<sub>3</sub>・エーテル錯体1.5gを少量ずつ約1分  
間で滴下した。その後、更に3時間反応を進行した。水  
に5%水酸化ナトリウム水溶液50mlを加えて30分放置し  
て、攪拌して触媒を分解した後、水層を分離し、更に重合  
油と中油になるまで蒸留した後、未反応油および溶媒ト  
ルエンを留去し、残渣としてポリ-α-メチルステレン12  
gを得た。当該ポリマーを精製2とし、物性を表2に示

【0066】・樹脂B3  
α-メタクリルステレン（純度98.8%）250g、イソプロペン  
α-メタクリルステレン50gおよびトルエン500gを3つのフラスコに  
入れ、溶剤中に三弗葉光ブレンジャーを少量ずつ  
添加し、ドライアイス/アセトン浴で冷却しながら20℃  
で長時間反応させた。次いで、アルコールを添加して懸濁  
液をろ過させて除去し、溶媒と未反応モノマーとを追い出  
すために減圧縮し、残渣と未反応モノマーとを樹  
脂B3中に示した。物性を表3に示した。

\* [表2]

重合体 (B)		Mw	Mn	Mw/Mn	Tg (°C)	粉砕性 指数
B1	ポリスチレン	1500	1000	1.5	62	0.3
B2	ポリ- $\alpha$ -チルチレン	2800	1500	1.9	75	0.5
B3	$\alpha$ -チルチレン-イソ $\alpha$ -ピナ レン共重合体	2400	1500	1.6	72	0.5
B4	$\alpha$ -チルチレン-イソ $\alpha$ -ピナ レン共重合体	1900	1100	1.7	65	0.3
B5	ポリスチレン	900	650	1.4	40	0.2
B6	ポリ- $\alpha$ -チルチレン	3100	1700	1.8	88	0.7

【0070】（原料マスターバッチの製造）フルカラートナーの製造に使用する原料は以下の方法によって得られた原料から製造する。各実施例または比較例または比較例で使用するバンダー樹脂は重量比（樹脂：糖粉）7:3の割合で加工ニードルに添加し、120℃で長時間混練した。冷却後、ハンダーミルで粗粉砕し、原料と含有量30重量%の原料マスターバッチを備えた、原料と含有量10重量%の原料（C.I. Pigment Yellow180（ヘキスト社）、C.I. Pigment Blue5-3（大日本インキ社）、C.I. Pigment Red45-1（大日本インキ社））を用いた。

【0071】 トナーMI  
ポリポリエステル樹脂AIおよび顔料マスターバッチを、ポリ  
エステル樹脂A1：100重量部およびVC、I. Pigment Red57-

\* [0067]・樹脂B4  
 イソナフレンニルトルエン（純度98%）200g、 $\alpha$ -メチル  
 スチレン（純度98%）200g、石油ナフサの熱分解によつ  
 て得られるC5系石油留分（イソブレン）120g、および  
 トルエン500gを三つ口フラスコに入れ、攪拌下に三異  
 ホウメチルエーテル結体を少量ずつ添加し、ドライアイス  
 ・アセトン浴で冷却しながら、激しく攪拌して触媒を分解し、  
 OH基を分離して油状の重合物を得た。さらに油状の  
 後、水相を分離して油状の重合物を得た。さらに油状の  
 重合物を中性になるまで水洗した後、未反応油および溶  
 媒を減圧蒸留除去し、残渣として白色塊状の $\alpha$ -メチル  
 スチレン・イソブレンプロピレンニルトルエン・イソブレン共重合  
 体を得た。当該ポリマーを樹脂B4とし、物性を表2に示  
 した。

[0068]・樹脂B5  
 リス炭素を2時間とじ以外は、樹脂B1と同じ製法でポ  
 リスチレンを得た。当該ポリマーを樹脂B5とし、物性を  
 表2に示した。

・樹脂B6  
反応時間を4.5時間とした以外は、樹脂B2と同じ製法でポリ- $\alpha$ -メチルスチレンを得た。当該ポリマーを樹脂B6とし、物性を表2に示した。

[0069]  
[装2]

1:5重量部となるように用い、これに糊剤B1を10重量部添加し、ベンジエールミキサーで混合した後、エクストルーダータにより熔融混練した。得られた造粒物を冷却した後、粗粉砕および微粉砕して、体積平均粒径 $5.5\mu\text{m}$ の粉砕物を付した。その後、粉砕物を分級して体積平均粒径 $6\mu\text{m}$ のトナー粒子を得た。このトナー粒子100重量部に対して、疎水性シリカ (H2000; ヘキスト社製) 0.9重量部、疎水性酸化チタン (粒径50nm) 0.9重量部、およびチタノ酸スズクロムチタン (粒径350nm、BET比表面積 $200\text{m}^2/\text{g}$ ) 2.0重量部を添加し、ベンジエールミキサーで混合処理した。アセトントナー (M1) を得た。

【0072】トナーY1およびCI  
顔料マスターパーチを変更し、ポリエステル樹脂AIおよび



評価	付着量 (g/m <sup>2</sup> )	生産性	耐熱 保管性	粒状性	帯電性	低温 定着性	トナー組成				粒径 ( $\mu$ m)	重合体(B) 樹脂	着色剤** 使用量(部)		
							A1	B1/10	A2	B1/10					
実施例6	3.5	◎	○	○	○	◎	ト-M6	5	A1	B1/10	6.5	◎	◎	◎	
							ト-C6	5	A1	B1/10	9				
							ト-K6	5	A1	B1/10	8				
							ト-M7	5	A2	B1/10	5				
							ト-Y7	6	A2	B1/10	8.5				
実施例7	4.5	◎	○	○	◎	△	ト-C7	6	A2	B1/10	7	◎	◎	◎	
							ト-K7	6	A2	B1/10	8				
							ト-M8	6	A1	-/0	5				
							ト-Y8	6	A1	-/0	8.5				
							ト-C8	6	A1	-/0	7				
比較例1	4.5	×	×	○	○	×	ト-K8	6	A1	-/0	8	○	○	○	
							ト-Y9	6	A1	B1/25	5				
							ト-C9	6	A1	B1/25	8.5				
							ト-K9	6	A1	B1/25	7				
							ト-M10	8	A1	B1/10	3.5				
比較例2	4.5	×	○	○	○	◎	○	ト-K10	8	A1	B1/10	8	◎	◎	◎
								ト-Y10	8	A1	B1/10	6			
								ト-C10	8	A1	B1/10	5.3			
								ト-K10	8	A1	B1/10	8			
								ト-M10	8	A1	B1/10	3.5			
比較例3	7	◎	○	○	×	◎	△	ト-K10	8	A1	B1/10	8	◎	◎	◎
								ト-Y10	8	A1	B1/10	6			
								ト-C10	8	A1	B1/10	5.3			
								ト-K10	8	A1	B1/10	8			
								ト-M10	8	A1	B1/10	3.5			

\*バインダー樹脂100重量部に対する重合体(B)の使用量を示す。

比較例5	比較例4				比較例3				比較例2				比較例1						
	付着量	生産性	耐熱保管性	粒状性	帯電性	低湿定着性	付着量	生産性	耐熱保管性	粒状性	帯電性	低湿定着性	付着量	生産性	耐熱保管性	粒状性	帯電性	低湿定着性	
比較例5	7-K12	6	A1	B6/10	8	4.5	◎	×	○	◎	×	○	△	比較例5	7-K12	6	A1	B6/10	8
	7-C12	6	A1	B6/10	7														
	7-Y12	6	A1	B6/10	8.5														
	7-M12	6	A1	B6/10	5														
	7-K11	6	A1	B5/10	8														
比較例4	7-C11	6	A1	B5/10	7	4.5	◎	×	○	×	◎	比較例4	7-M11	6	A1	B5/10	5		
	7-Y11	6	A1	B5/10	8.5														
	7-K11	6	A1	B5/10	8														
	7-C11	6	A1	B5/10	7														
	7-Y11	6	A1	B5/10	8.5														
比較例3	7-K11	6	A1	B5/10	8	4.5	◎	×	○	◎	比較例3	7-M11	6	A1	B5/10	5			
	7-Y11	6	A1	B5/10	8.5														
	7-K11	6	A1	B5/10	8														
	7-C11	6	A1	B5/10	7														
	7-Y11	6	A1	B5/10	8.5														
比較例2	7-K12	6	A1	B6/10	8	4.5	◎	×	○	◎	△	比較例2	7-M12	6	A1	B6/10	5		
	7-C12	6	A1	B6/10	7														
	7-Y12	6	A1	B6/10	8.5														
	7-M12	6	A1	B6/10	5														
	7-K11	6	A1	B5/10	8														
比較例1	7-K11	6	A1	B5/10	8	4.5	◎	×	○	◎	△	比較例1	7-M11	6	A1	B5/10	5		
	7-Y11	6	A1	B5/10	8.5														
	7-K11	6	A1	B5/10	8														
	7-C11	6	A1	B5/10	7														
	7-Y11	6	A1	B5/10	8.5														

\*バインダー樹脂100重量部に対する重合体(B)の使用量を示す。

管、滴下装置を備えた容量500mlのフラスコにメチルエチルケトンに100重量部仕込んだ、塩素系固定剤下80℃でメチルメタクリレート86.7重量部、2-ヒドロキシエチルメタクリレート5.1重量部、3-メタクリロキシプロピルトリス(トリメチルシロキシ)シラン58.2重量部および、1-アンピス(シクロヘキサン-1-カルボニトリル)1重量部を、メチルエチルケトン100重量部に溶解させて得られた溶液を2時間におたり反応器中に滴下し、5時間熟成させた。得られた樹脂に対して、架橋剤としてイソホンジイソシアネート/トリメチロールプロパンアダクト(IPDI/TMP系：NCO%≒6.1%)を40/60モル比で添加し、1/1となるように調整した後メチルエチルケトンで希釈して固形比8重量%であるコート樹脂溶液を調製した。

【0088】コア材として合成フェライト粉F-800(体積平均粒径：50 $\mu$ m、バクテラ社製)を用い、上記コート樹脂溶液をコア材に対する被覆樹脂量が1.5重量%になるようにスピラコーター(岡田精工社製)により塗布・乾燥した。得られたキャリアを乾燥機式オーブンにて160℃で1時間放置して乾燥した。冷却後フェライト粉バグを目開き106 $\mu$ mと75 $\mu$ mのスクリーンメッシュを取り付けたフルイ振とう器を用いて溶解し、アクリル変性シリコンコートフェライトキャリアを得た。

【0089】(他の測定方法)

・樹脂の軟化点T<sub>g</sub>の測定法  
フローマスター(GFT-500、島津製作所社製)を用い、ダイスの細孔(径1mm、長さ1mm)、加圧30kg/cm<sup>2</sup>、昇温速度2℃/minの条件で1cm<sup>3</sup>の試料を溶融流出させたときの流出開始点から流出終了点の長さの1/2に相当する温度を軟化点とした。

・酸価は、10mgの試料をトルエン5mlに溶解し、0.1%のプロムデキセルブルーとフェノールレッドの混合指示薬を用いて、予め調整されたN/10水酸化カリウム/アルコール溶液で滴定し、N/10水酸化カリウム/アルコール溶液の消費量から算出した値である。

【0090】・トナーの粒径はコールターマルチサイザーIIを用いて測定した。

・無機微粒子の平均粒径は透過型電子顕微鏡(TEM-1010型；日本電子株式会社)で観察し、粒子100個の直径を測定し、平均粒径を求めた。

【0091】

【0087】(アクリル変性シリコンコートフェライトの製造) 攪拌器、コンデンサー、温度計、塩素導入

【0086】

【表5】

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## (54) METHOD FOR FORMING FULL-COLOR IMAGE

## (57)Abstract:

PROBLEM TO BE SOLVED: To provide a method for forming a full-color image by which high-quality full-color images can be fast obtained at a low cost.

SOLUTION: In the method for forming a full-color image, a magenta developer containing a magenta toner, a cyan developer containing a cyan toner, a yellow developer containing a yellow toner, and a black developer containing a black toner are used as the developer. Each toner has 3 to 7.5  $\mu$ m volume average particle size contains at least 100 pts.wt. of a binder resin, 1 to 20 pts.wt. of a polymer (B) having 1,000 to 3,000 weight average mol.wt. and  $\leq 2.0$  ratio of weight average mol.wt./number average mol.wt., and a coloring agent. Each maximum deposition amount of the magenta toner, cyan toner and yellow toner on the recording material is controlled to  $\leq 5.0$  g/m<sup>2</sup>.

## LEGAL STATUS

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**JAPANESE** [JP,2002-131973,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE  
INVENTION TECHNICAL PROBLEM MEANS EXAMPLE

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[Translation done.]

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**CLAIMS**

[Claim(s)]

[Claim 1] The process which forms a latent image on an electrostatic latent-image support, and develops this latent image with a developer, And the process imprinted on a recorded material, without minding the toner image formed on the electrostatic latent-image support through a middle imprint object It is the full color image formation method including the toner image which carried out repeatedly for every color of a developer and was imprinted on the recorded material being established. The Magenta developer which contains a Magenta toner as a developer, the cyano developer containing a cyano toner, While each toner has 3-7.5 micrometers of volume mean particle diameters using the yellow developer containing a yellow toner, and the black developer containing a black toner at least -- a binder -- a resin -- 100 -- a weight -- the section -- weight average molecular weight -- 1000 - 3000 -- and -- weight average molecular weight -- /-- number average molecular weight -- 2.0 -- less than -- a polymer -- (-- B --) -- one - 20 -- a weight -- the section -- and -- a coloring agent -- containing -- becoming -- The full color image formation method characterized by controlling the maximum coating weight to the recorded material of a Magenta toner, a cyano toner, and a yellow toner to a two or less 5.0 g/m value, respectively.

[Claim 2] The full color image formation method according to claim 1 characterized by controlling the maximum coating weight to the recorded material of a Magenta toner, a cyano toner, and a yellow toner to the two or less 5.0 g/m same value.

[Claim 3] The full color image formation method according to claim 1 or 2 that a polymer (B) is the homopolymer or copolymer of an aromatic monomer and/or an aliphatic monomer.

[Claim 4] the claims 1-3 whose glass transition points of a binder resin are 50-60 degrees C -- the full color image formation method given in either

[Claim 5] the kind and amount of an after-treatment agent of a Magenta toner, a cyano toner, and a yellow toner -- abbreviation -- the same claims 1-4 -- the full color image formation method given in either

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[Translation done.]

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[Translation done.]

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**JAPANESE** [JP,2002-131973,A]

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the full color image formation method.

[0002]

[Description of the Prior Art] Generally, the full color image formation method forms a latent image on an electrostatic latent-image support (photo conductor), and comes to contain the process (development process) which develops this latent image with a toner, the process (imprint process) imprinted on a recorded material, without minding the toner image formed on the electrostatic latent-image support through a middle imprint object, and the process (fixing process) established in the toner image on a recorded material. After developing negatives for every color and piling up a toner layer on a recorded material in detail using the toner of four colors of a Magenta color, a yellow color, a cyano color, and a black color, a toner layer is established by pressurization and heating. It is common in a binder resin, a coloring agent, etc. coarse grinding melting and after kneading and cooling, and to pulverize, to classify by request and to obtain the toner used for such an image formation method at least.

[0003] In recent years, in the field of the above full color image formation methods, improvement in the speed and low-cost-izing of image formation are demanded of the high definition-ized row of a picture, and various attempts are made about the image formation process and the toner.

[0004] For example, in order to attain high definition-ization of a picture, it is known that it is effective to make the mean particle diameter of a toner small. However, since the specific surface area of a toner increased by minor diameter-ization of a toner, there was an inclination for the amount of toner electrifications per unit weight to become high. When the amount of electrifications became high too much, the problem that the amount of development was restricted and desired picture concentration was not obtained arose. Then, in order to prevent the fall of picture concentration, in JP,9-114127,A, the attempt which specifies the volume mean particle diameter of a toner, a color-material content, and the toner weight of the solid section on tracing paper is made. According to this convention, also in the diameter toner of a granule, desired picture concentration is securable by raising a color-material content. However, if a color-material content was raised, since the electric charge nature of a toner would be greatly influenced by the electric charge performance which color material has, the maximum coating weight of development conditions and a toner [ especially as opposed to a recorded material ] needed to be changed comparatively greatly for every toner. If the difference of the maximum coating weight of a toner to the recorded material for every toner is too large, the conditioning for every toner at the time of development is complicated, and improvement in the speed and low-cost-izing of full color image formation cannot be attained. Moreover, the amount of electrifications needed to be adjusted with material other than color material for



every toner at the time of toner manufacture.

[0005] Moreover, in the manufacturing process of a ground type toner, although the pulverizing process had required the long time comparatively, it was difficult for pulverizing to take a long time further to minor diameter-ization of a toner, and for productivity to fall, and to attain low-cost-ization as a result. Then, the technology of making the toner constituent before kneading containing a specific petroleum resin, and raising the grindability of a toner constituent is reported by JP,11-65161,A. Here, in order to secure the preservation stability of a toner as a binder resin, a resin 60 degrees C or more is used for a glass transition point. However, when the toner by the technology concerned was used, fixing took the long time comparatively, and improvement in the speed of full color image formation was not attained.

[0006] In order to attain improvement in the speed of full color image formation, increasing the color-material content of a toner and reducing the coating weight of a toner to a recorded material and lowering the melting start temperature of a toner binder resin are proposed. However, if the coating weight of a toner was reduced, in order that the number of composition toners per pixel might decrease, there was a problem that the graininess of the picture acquired got worse. That is, the coarse picture of a texture was acquired. Moreover, when melting start temperature used the low binder resin comparatively, there was a problem that toner condensation tends to take place. That is, when a toner was comparatively saved under an elevated temperature, condensation took place, and condensation took place by churning into the development counter.

[0007]

[Problem(s) to be Solved by the Invention] this invention is made in view of the above-mentioned situation, and it aims at offering the full color image formation method that it is high-speed and cheap and a high definition full color picture can be offered.

[0008] Even if this invention does not change the maximum coating weight of a toner to a recorded material for every toner, it aims at offering the full color image formation method that it is high-speed and cheap and a high definition full color picture can be offered again.

[0009]

[Means for Solving the Problem] The process which this invention forms a latent image on an electrostatic latent-image support, and develops this latent image with a developer, And the process imprinted on a recorded material, without minding the toner image formed on the electrostatic latent-image support through a middle imprint object It is the full color image formation method including the toner image which carried out repeatedly for every color of a developer and was imprinted on the recorded material being established. The Magenta developer which contains a Magenta toner as a developer, the cyano developer containing a cyano toner, While each toner has 3-7.5 micrometers of volume mean particle diameters using the yellow developer containing a yellow toner, and the black developer containing a black toner at least -- a binder -- a resin -- 100 -- a weight -- the section -- weight average molecular weight -- 1000 - 3000 -- and -- weight average molecular weight -- / -- number average molecular weight -- 2.0 -- less than -- a polymer -- (-- B --) -- one - 20 -- a weight -- the section -- and -- a coloring agent -- containing -- becoming -- It is related with the full color image formation method characterized by controlling the maximum coating weight to the recorded material of a Magenta toner, a cyano toner, and a yellow toner to the value of two or less [ 5.0g //m ], respectively.

[0010] When the specific polymer (B) was used, even if he made the toner the diameter of a granule and filled up this toner with comparatively a lot of coloring agents, the artificer of this invention etc. found out that the difference of the electrification level between the toners of each color was reduced, and found out that the purpose of this invention was attained easily by using still such a toner on specific development conditions.

[0011]

[Embodiments of the Invention] The developer used for the method of this invention may be 2

component developer which mixes a toner and a carrier and is obtained, or may be 1 component developer which uses a toner independently. Moreover, although used combining the Magenta developer which contains a Magenta toner as a developer in this invention, the cyano developer containing a cyano toner, the yellow developer containing a yellow toner, and the black developer containing a black toner, as long as it is not limited to this and can form a full color picture, you may use combining the developer of other colors.

[0012] Hereafter, although a toner is explained first, unless it mentions specially, the following explanation may be applied independently to a Magenta toner, a cyano toner, a yellow toner, and a black toner, respectively.

[0013] The toner used in this invention comes to contain a binder resin, a specific polymer (B), and a coloring agent at least. In order to use a specific polymer (B) which is explained in full detail in this invention later, a toner has the composition which the polymer (B) exposed to the particle front face. Since a toner has such composition, even if it fills up with comparatively a lot of coloring agents, the probability that a coloring agent will be exposed to the particle front face of a toner is considered that it decreases notably and the difference of the electrification level between the toners of each color based on the difference in the electrification performance of each coloring agent is reduced. Moreover, since a toner has the above composition, the effect that toner condensation stops being able to happen easily is also acquired. The effect that the productivity of a toner improves is also acquired by furthermore using a polymer (B).

[0014] If a polymer (B) is used in manufacture of a toner, in a kneading process, a polymer (B) is distributed as a particle in a binder resin, and since it is ground while a trituration side is formed so that a kneading object may connect the particulate material of a polymer (B) with a trituration process, it will be thought that the toner which has the composition which the polymer (B) exposed to the particle front face is obtained. In detail, in the place where the polymer (B) particle in a kneading object exists, since trituration takes place not through the contact surface (interface) of a binder resin and a polymer (B) particle but through the interior of a polymer (B) particle, the trituration side concerned is constituted by the polymer (B) and it is thought that a polymer (B) is exposed to a particle front face as a result.

[0015] the polymer (B) used in this invention -- weight average molecular weight (Mw) -- 1000-3000 -- 1000-2800, and weight average molecular weight/number average molecular weight (Mw/Mn) are 1.9 or less preferably 2.0 or less If such a polymer (B) is not used, the toner of composition of having exposed to the particle front face cannot be obtained, but the difference of the electrification level between the toners of each color will need to become comparatively large, and a polymer (B) will need to change the maximum coating weight comparatively greatly for every toner, and will become complicated [ the conditioning for every toner at the time of development ]. Furthermore, since the glass transition point of a polymer (B) becomes it low that Mw of a polymer (B) is less than 1000, the storage nature (heat-resistant storage nature) when leaving a toner at comparatively high temperature gets worse, and use becomes difficult practically. On the other hand, if Mw exceeds 3000, the own grindability of this material will become bad and the improvement effect of the grindability by using this material will no longer be accepted.

[0016] Mw and Mn of a polymer or a resin use the value measured by the gel permeation chromatography (807-IT type; Japan a spectrum industrial company make) among this specification. In detail, the column was kept at 40 degrees C, and 30mg of samples which pass and measure a tetrahydrofuran by 10 kg/cm<sup>3</sup> as a carrier solvent was dissolved in tetrahydrofuran 20ml, and 0.5mg of this solution was introduced with the above-mentioned carrier solvent, and it asked for it by polystyrene conversion.

[0017] As for such a polymer (B), it is preferably desirable the grindability indices 0.1-1.0 and to have 0.2-0.6. A grindability index is one index of it being ground and expressing easy, and means that it is easy to be ground, so that the value concerned is small.

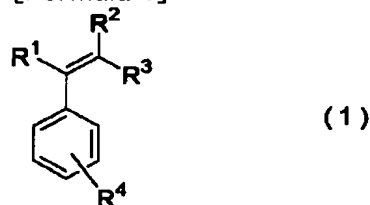
[0018] The grindability index uses the value measured according to the following among this specification. In case a mechanical grinder (KTM-0 type : Kawasaki Heavy Industries, Ltd. make) grinds the sample of about 2mm of volume mean particle diameters at Throughput F (5 kg/h) and the KTM rotational frequency 12000 (rpm), the load power value W1 when passing the load power value W0 and sample at the time of sample passage nothing is recorded. Then, the volume mean particle diameter D of the trituration object obtained by KTM trituration (micrometer) is measured by the coal tar multi-sizer II (made in coal tar Beckmann). Based on the following formula, a grindability index is computed from the acquired value.

Grindability index  $= (D \times (W1 - W0)) / F$  [0019] Moreover, as for the glass transition point ( $T_g$ ) of a polymer (B), it is preferably desirable from the viewpoint of the further improvement in heat-resistant storage nature and low-temperature fixing nature that it is 60–80 degrees C more preferably 55–85 degrees C 50 degrees C or more. Among this specification, using the differential scanning calorimeter (DSC-200:SEIKO electronic company make), the glass transition point of a polymer or a resin uses a reference as an alumina, measures a 10mg sample among 20–120 degrees C on condition that 10 degrees C of programming rates, and min, and makes the shoulder value of a main endothermic peak the glass transition point.

[0020] As long as it does not dissolve as a kind of polymer (B) even if melting kneading of the polymer (B) is carried out with a binder resin, and a binder resin differs from a grindability, it is not restricted, for example, the homopolymer or copolymer of a well-known aromatic monomer and/or an aliphatic monomer can be used. It means that "a binder resin differs from a grindability" has [ 0.5 or more / 0.7 or more ] the grindability index of a polymer (B) preferably smaller than the grindability index of a binder resin here. By using the polymer (B) and binder resin which have the relation of such a grindability index, a polymer (B) can obtain effectively the toner exposed to the front face.

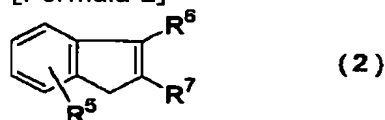
[0021] As an aromatic monomer, it is a general formula (1);

[Formula 1]



It is [ the styrene system monomer expressed with (R1, R2, R3, and R4 being a hydrogen atom, a halogen atom or the alkyl group of carbon numbers 1–4, for example, a methyl group, an ethyl group, n-propyl group, and n-butyl independently among a formula, respectively, and being a hydrogen atom, a chlorine atom, a bromine atom, or a methyl group preferably), and ] a general formula (2);

[Formula 2]



The indene system monomer expressed with (R5, R6, and R7 being a hydrogen atom, a halogen atom or the alkyl group of carbon numbers 1–6, for example, a methyl group, an ethyl group, n-propyl group, n-butyl, n-pentyl machine, and n-hexyl machine independently among a formula, respectively, and being a hydrogen atom, a chlorine atom, a bromine atom, or a methyl group preferably) is mentioned.

[0022] As an example of a styrene system monomer, for example Styrene, vinyltoluene, An alpha methyl styrene, isopropenyl toluene, beta-methyl styrene, 1-propenyl toluene, o-chloro styrene, m-chloro styrene, p-chloro styrene, alpha-chloro styrene, beta-chloro styrene,

o-bromostyrene, m-bromostyrene, p-bromostyrene, alpha-bromostyrene, beta-bromostyrene, etc. are mentioned. Preferably Styrene, vinyltoluene, an alpha methyl styrene, isopropenyl toluene, beta-methyl styrene and 1-propenyl toluene -- more -- desirable -- styrene, vinyltoluene, an alpha methyl styrene, and isopropenyl toluene -- they are styrene, an alpha methyl styrene, and isopropenyl toluene still more preferably As an example of an indene system monomer, for example, an indene, a methyl indene, an ethyl indene, etc. are mentioned, and especially an indene is desirable also in these. In this case, it is desirable when using a pure monomer with high purity stops coloring of a resin, an odor, and the amount of VOC(s) low. An aromatic monomer is independent, or may be combined and used.

[0023] As an example of an aliphatic monomer, especially if the above-mentioned aromatic monomer and a polymerization are possible, it will not be restricted. For example, an isoprene, a piperylene, 1,3-butadiene, 1, 3-pentadiene, 1, 5-hexadiene, 2, 3-dimethyl-1,3-butadiene, a chloroprene, Diolefin system monomers, such as 2-BUROMO-1,3-butadiene; Ethylene, A propylene, a butylene, an isobutylene, 2-methyl-butene-1, the monoolefin system monomer of 2-methylbutene-2 grade; A methyl acrylate, An ethyl acrylate, an acrylic-acid n-propyl, an acrylic-acid isopropyl, Acrylic-acid n-butyl, isobutyl acrylate, acrylic-acid t-butyl, An acrylic-acid n-pentyl, an acrylic-acid isopentyl, acrylic-acid neopentyl, Acrylic-acid 3-(methyl) butyl, an acrylic-acid hexyl, an acrylic-acid octyl, Acrylic-acid alkyl ester system monomers, such as an acrylic-acid nonyl, an acrylic-acid desyl, an acrylic-acid undecyl, and an acrylic-acid dodecyl; A methyl methacrylate, An ethyl methacrylate, a methacrylic-acid n-propyl, a methacrylic-acid isopropyl, Methacrylic-acid n-butyl, a methacrylic-acid isobutyl, methacrylic-acid t-butyl, A methacrylic-acid n-pentyl, a methacrylic-acid isopentyl, methacrylic-acid neopentyl, Methacrylic-acid 3-(methyl) butyl, a methacrylic-acid hexyl, a methacrylic-acid octyl, A methacrylic-acid nonyl, a methacrylic-acid desyl, a methacrylic-acid undecyl, Alkyl methacrylate ester system monomers, such as a methacrylic-acid dodecyl; An acrylic acid, Unsaturated-carboxylic-acid system monomers, such as a methacrylic acid, an itaconic acid, and a maleic acid; Acrylonitrile, A maleate, itaconic-acid ester, a vinyl chloride, vinyl acetate, a benzoic-acid vinyl, a vinyl methyl ethyl ketone, a vinyl hexyl ketone, a vinyl methyl ether, vinyl ethyl ether, the vinyl isobutyl ether, etc. are mentioned. It is a monoolefin system monomer and a diolefin system monomer preferably, and is an isoprene preferably [ it is more desirable and ] to an isoprene, a piperylene, 2-methyl-butene-1, the 2-methylbutene -2, and a pan. A \*\*\*\* monomer is independent, or may be combined and used.

[0024] The homopolymer or copolymer of the aromatic monomer and/or aliphatic monomer whose aliphatic monomer an aromatic monomer is 1 or the monomer beyond it chosen from the group which consists of styrene, an alpha methyl styrene, and isopropenyl toluene, and is an isoprene also in the polymer (B) which consists of the above monomers is desirable.

[0025] What was compounded considering the diolefin and/or monoolefin which are contained in the decomposition oil fraction by which the byproduction was carried out as such a desirable polymer (B) from the plant which manufactures ethylene, a propylene, etc. by steam cracking of petroleum as a raw material may be used preferably.

[0026] Moreover, they are polystyrene and the Polly alpha methyl styrene preferably from a viewpoint which a polystyrene, Polly alpha-methyl-styrene, and styrene-alpha-methyl-styrene copolymer, an alpha-methyl-styrene-isopropenyl toluene copolymer, a styrene-isopropenyl toluene copolymer, an alpha-methyl-styrene-isopropenyl toluene-isoprene copolymer, a styrene-isopropenyl toluene-isoprene copolymer, etc. are mentioned, and reduces further the difference of the electrification level between the toners of each color as an example of the above desirable polymers (B).

[0027] When using polystyrene as a polymer (B), as for the weight average molecular weight, it is still more desirable that it is 1000-2000. Moreover, when using the Polly alpha methyl styrene as a polymer (B), as for the weight average molecular weight, it is still more desirable that it is 2000-2800.

[0028] the amount of the polymer (B) used -- the binder resin 100 weight section -- receiving -- 1 - 20 weight section -- it is 3 - 15 weight section preferably If there is too little amount used, the improvement effect of the grindability of a toner constituent will be hard to be acquired. When there is too much amount used, a toner becomes that overgrinding is easy to be carried out, and there is an inclination for toner particle size to change a lot in a development counter.

[0029] It is not restricted especially as a binder resin, but well-known synthetic resin or well-known natural resin can be used in the field of the toner for electrostatic-charge image development. For example, a polyester system resin, a styrene resin, a polyvinyl chloride, phenol resin, natural denaturation phenol resin, natural denaturation maleic resin, an acrylic resin, an methacrylic system resin, polyvinyl acetate, silicone resin, polyurethane, polyamide resin, a furan resin, an epoxy resin, a xylene resin, a polyvinyl butyral, a terpene resin, a cumarone indene resin, etc. are mentioned. Preferably, the polyester system resin which made a polyester system resin or styrene-acrylic resin graft-ize is mentioned. In this invention, it is more desirable to use a polyester system resin from a viewpoint of the further improvement in low-temperature fixing nature.

[0030] Although specifying the softening temperature of a binder resin as a means which raises the low-temperature fixing nature of a toner from the former was often performed, in this invention, it found out that the direction of a glass transition point correlated with low-temperature fixing nature well from the softening temperature of a binder resin. Therefore, as for a binder resin, in this invention, it is desirable for 45-65 degrees C of the viewpoint of the further improvement in heat-resistant storage nature and low-temperature fixing nature to glass transition points to be 50-60 degrees C preferably. In addition, as for the softening temperature of a binder resin, it is desirable that it is 120 degrees C or less from the color-reproduction nature and the glossy viewpoint of a full color picture.

[0031] The polyester resin obtained by carrying out the polycondensation of a polyhydric-alcohol component and the multiple-valued carboxylic-acid component as a polyester system resin in this invention is usable. Among polyhydric-alcohol components, as a dihydric alcohol component For example, polyoxypropylene (2 2) -2, 2-screw (4-hydroxyphenyl) propane, Polyoxypropylene (3 3) -2, 2-screw (4-hydroxyphenyl) propane, Polyoxypropylene (6) -2, 2-screw (4-hydroxyphenyl) propane, A polyoxyethylene (2 0) -2, 2-screw (4-hydroxyphenyl) propane, The bisphenol A alkylene oxide addition products, such as a polyoxyethylene (2 2) -2 and 2-screw (4-hydroxyphenyl) propane, Ethylene glycol, a diethylene glycol, a triethylene glycol, 1, 2-propylene glycol, 1, 3-propylene glycol, 1, 4-butanediol, Neopentyl glycol, 1, 4-butene diol, 1,5-pentanediol, 1, 6-hexandiol, 1, 4-cyclohexane dimethanol, a dipropylene glycol, a polyethylene glycol, a polytetramethylene glycol, bisphenol A, hydrogenation bisphenol A, etc. are mentioned. As an alcoholic component more than trivalent, they are a sorbitol, 1, 2 and 3, 6-hexane tetrol, 1, 4-sorbitan, a pentaerythritol, dipentaerythritol, tripentaerythritol, 1 and 2, 4-butane triol, 1 and 2, 5-pentanetriol, a glycerol, isobutane triol, and 2-methyl, for example. - 1, 2, 4-butane triol, trimethylolethane, a trimethylol propane, 1 and 3, 5-trihydroxy methylbenzene, etc. are mentioned.

[0032] Moreover, as a divalent carboxylic-acid component, the anhydride or low-grade alkyl ester of a maleic acid, a fumaric acid, a citraconic acid, an itaconic acid, a glutaconic acid, a phthalic acid, an isophthalic acid, a terephthalic acid, a cyclohexane dicarboxylic acid, a succinic acid, an adipic acid, sebacic acid, an azelaic acid, a malonic acid, an n-dodecenyl succinic acid, an iso dodecenyl succinic acid, n-dodecyl succinic acid, an iso dodecyl succinic acid, n-OKUTE nil succinic acid, an iso OKUTE nil succinic acid, n-octyl succinic acid, iso octyl succinic acids, and

[0033] As a carboxylic-acid component more than trivalent, for example 1, 2, 4-benzene tricarboxylic acid (trimellitic acid), 1, 2, 5-benzene tricarboxylic acid, 2 and 5, 7-naphthalene tricarboxylic acid, 1 and 2, 4-naphthalene tricarboxylic acid, 1, 2, 4-butane tricarboxylic acid, 1

and 2, 5-hexane tricarboxylic acid, 1 A 3-dicarboxyl-2-methyl-2-methylene carboxy propane, The anhydride of 1, 2, 4-cyclohexane tricarboxylic acid, tetrapod (methylene carboxyl) methane, 1, 2 and 7, 8-octane tetracarboxylic acid, pyromellitic acid, en pole trimer acids, and these acids, low-grade alkyl ester, etc. are mentioned.

[0034] The polyester resin obtained considering at least one sort chosen from the group which makes a principal component the bisphenol A alkylene oxide addition product as a polyhydric-alcohol component, and consists of a terephthalic acid, a fumaric acid, a dodecenyl succinic acid, and a benzene tricarboxylic acid as a multiple-valued carboxylic-acid component also in the polyester resin which consists of the above monomer components as a principal component is desirable.

[0035] The polyester resin obtained from a viewpoint of the further improvement in low-temperature fixing nature, using a terephthalic acid and a fumaric acid as a multiple-valued carboxylic-acid component, using polyoxypropylene (2 2) -2, 2-screw (4-hydroxyphenyl) propane (it being called "PO") and a polyoxyethylene (2 2) -2, and 2-screw (4-hydroxyphenyl) propane (it being called "EO") as a polyhydric-alcohol component is desirable. At this time, it is still more desirable than PO to use many EO(s) and to use many fumaric acids rather than a terephthalic acid. It is for making it a glass transition point not become high too much, maintaining a desired grindability index.

[0036] When using the above polyester resin as a binder resin, as for the acid number, it is preferably desirable that it is 3 - 20 KOHmg/g three to 30 KOHmg/g. While raising the dispersibility of the pigment which contains carbon black by using the polyester resin of such the acid number, or an electrification control agent, the toner which has more sufficient amount of electrifications can be obtained.

[0037] In order to control the glossiness of a picture in the full color toner which the fixing nature as a toner for heat roller fixing and offset-proof nature are raised especially in this invention, and needs a translucency, you may use two kinds of polyester resin from which softening temperature differs as polyester resin. At this time, the acid number of those mixed resins should just be above-mentioned within the limits.

[0038] As a coloring agent used by this invention, the well-known pigment and well-known color which are used as a coloring agent for full color toners from the former are usable. For example, carbon black, activated carbon, titanium black, aniline blue, Cull coil blue, chrome yellow, ultra marine blue, E. I. du Pont de Nemours oil red, Quinoline yellow, methylene-blue chloride, a copper phthalocyanine, a Malachite-Green OKISA rate, Lamp black, a rose bengal, C. I. pigment red 48: 1, the C.I. pigment red 122, the C.I. pigment red 57:1, the C.I. pigment red 184, the C.I. pigment yellow 12, the C.I. pigment yellow 17, the C.I. pigment yellow 93, C. I. pigment yellow 97, the C.I. pigment yellow 109, C.I. pigment yellow 110, the C.I. pigment yellow 155, the C.I. pigment yellow 180, C.I. pigment yellow 185, C. I. solvent yellow 162, the C.I. pigment blue 15:1, and C.I. pigment blue 15:3 grade can be mentioned. In a black toner, you may replace some or all of a coloring agent, such as various carbon black, activated carbon, and titanium black, with the magnetic substance. As the magnetic substance, well-known magnetic-substance particles, such as a ferrite, a magnetite, and iron, are usable, for example. The mean particle diameter of a magnetic particle has especially preferably desirable 0.5 micrometers or less 1 micrometer or less in the meaning which acquires the dispersibility at the time of manufacture. the case where the magnetic substance is added in viewpoints, such as scattering prevention, giving the property as a nonmagnetic toner to a toner -- the addition -- the binder resin 100 weight section -- receiving -- 0.5 - 10 weight section -- desirable -- 0.5 - 8 weight section -- it is 1 - 5 weight section more preferably

[0039] Although the content of a coloring agent should just be suitably determined according to the hiding power of a coloring agent, and the maximum coating weight at the time of image formation, even if it is filled up with comparatively a lot of coloring agents in this invention, since the electrification nature of the toner of each color hardly changes, using comparatively mostly

is more effective. For example, when the maximum coating weight of a toner to a recorded material is 4 g/m<sup>2</sup>, the range of 6.5 – 12 weight section and the C.I. pigment blue 15:3 are used [ the C.I. pigment red 57:1 ] for the range of 4 – 8 weight section, and the C.I. pigment yellow 180 in the range of 5.5 – 10 weight section (criteria are the binder resin 100 weight section). In addition, as for the coloring agent used for the toner of a Magenta, cyanogen, and yellow, it is desirable to be used as a masterbatch ground and obtained, after carrying out melting kneading beforehand with the binder resin used, and the amount of [ at that time used ] should just become above-mentioned [ the coloring agent content in the toner obtained ] within the limits. [0040] You may make a toner contain an electrification control agent and a release agent by request. As an electrification control agent for a Magenta toner, a cyano toner, and yellow toners, the electrification control agent of the colorlessness which does not have a bad influence on the color tone of a color toner and a translucency, white, or light color is usable, for example, the zinc of salicylic acid derivatives, the metal complex of chromium, a calyx arene system compound, an organic boron compound, a fluorine-containing quarternary-ammonium-salt system compound, etc. are used suitably. As the above-mentioned salicylic-acid metal complex, a thing with a thing given [ as an organic boron compound ] in JP,2-221967,A with a thing [ given in JP,53-127726,A, JP,62-145255,A, etc. ] given [ as a calyx arene system compound ] in JP,2-201378,A etc. is usable.

[0041] A wax is used as a release agent. As a wax, a well-known wax is usable in the field of the toner for electrostatic-charge image development, for example, a polyethylene wax, a polypropylene wax, carnauba wax, a rice wax, a SAZORU wax, a montan ester wax, the Fischer Tropsch wax, paraffin wax, etc. can be mentioned. Desirable especially as for the melting point of a desirable wax, it is 50–90 degrees C to use the wax of the low melting point from a viewpoint of the further improvement in low-temperature fixing nature and improvement in the separability from a fixing roller. The addition of a release agent has desirable 0.5 – 5 weight section to the binder resin 100 weight section.

[0042] It faces obtaining a toner, and first, after mixing other additives, for example, a release agent, an electrification control agent, etc. with well-known mixed equipments, such as a Henschel mixer, in a binder resin, an above-mentioned polymer (B), and an above-mentioned coloring agent row, with well-known kneading equipment, melting kneading is carried out, it cools and a kneading object is obtained. Subsequently, a kneading object is ground and classified and carries out momentary heat-treatment by request. Finally in this invention, 3–7.5 micrometers of volume mean particle diameters of a toner particle are 4–6.5 micrometers preferably. If particle size is too small, by increase of the surface area of a toner, the adhesion force between toners will be too high, and the condensation at the time of the time of storage and supply, and development will serve as a technical problem. If particle size is too large, level of graininess (fineness of a texture) required as a full color picture cannot be attained. As equipment for performing momentary heat-treatment, a SAFUYUJINGU system (Japanese pneumatic industrial company make) is usable, for example.

[0043] To a toner, it is desirable to add various organic one / inorganic particle (after-treatment agent) for the purpose of grant of a fluidity or cleaning nature. As a non-subtlety particle, for example Silicon carbide, a boron carbide, a titanium carbide, A zirconium carbide, a hafnium carbide, a vanadium carbide, a tantalum carbide, Carbonization niobium, a tungsten carbide, a chromium carbide, carbonization molybdenum, calcium carbide, Various carbide, such as a diamond carbon lactam, boron nitride, a titanium nitride, Various borides, such as various nitrides, such as a zirconium nitride, and a zirconium boride, Titanium oxide, a calcium oxide, a magnesium oxide, a zinc oxide, a copper oxide, Various oxides, such as an aluminum oxide, a silica, and colloidal silica, titanate-acid calcium, Various titanate-acid compounds, such as titanate-acid magnesium and a strontium titanate, Various fluorides, such as various sulfides [ , such as molybdenum disulfide ] and magnesium fluoride, carbon, etc. fluoride, independent in various nonmagnetic inorganic particles, such as various metallic soaps, such as an aluminum

stearate, a calcium stearate, a zinc stearate, and a magnesium stearate, talc, and a bentonite, -- or it can combine and use

[0044] As an organic particle, particles, such as the styrene system which corned for the purpose, such as a cleaning assistant, by wet polymerization methods, such as an emulsion-polymerization method, a soap free emulsion-polymerization method, and a non-moisture powder polymerization method, the gaseous-phase method, etc., acrylic (meta), benzoguanamine, a melamine, Teflon (registered trademark), silicon, polyethylene, and polypropylene, can be used.

[0045] As for a non-subtlety particle especially a silica, titanium oxide, an alumina, a zinc oxide, etc., it is desirable that surface treatment is carried out by the well-known method from a viewpoint of heat-resistant storage nature and environmental-proof stability using processing agents which have the hydrophobing processing agent currently used from the former, such as a silane coupling agent, a titanate system coupling agent, a silicone oil, and a silicone varnish, a fluorine system silane coupling agent, a fluorine system silicone oil, an amino group, and a quarternary-ammonium-salt machine, such as a coupling agent and a denaturation silicone oil.

[0046] the composition of the particle (after-treatment agent) \*(ed) by a Magenta toner, a cyano toner, and the yellow toner outside in this invention -- abbreviation same -- suppose that it is desirable and is the same here -- composition -- " -- it judges for all the after-treatment agents by which that it is [ abbreviation same ]" or "it is the same" were added more than the 0.3 weight section to the toner 100 weight section in each toner -- having -- respectively -- each toner -- setting -- a kind and an amount -- " -- it shall mean that abbreviation same" or the "same" after-treatment agent is added in common what the kind of after-treatment agent includes the chemical formula with which the raw material of a particle is expressed, and primary [ an average of ] particle size, and is meant -- carrying out -- especially -- the kind of after-treatment agent -- abbreviation -- being the same -- a chemical formula with the particle raw material same irrespective of the existence of surface treatment -- it can express -- and -- this -- the first [ an average of ] particle size in each toner of the after-treatment agent expressed with the same chemical formula means that it is within the limits which is \*\*20% of those averages, respectively moreover, the amount of an after-treatment agent -- abbreviation -- being the same -- the above -- it means that the addition (addition to the toner 100 weight section) in each toner of the after-treatment agent expressed with the same chemical formula is within the limits of \*\*20% of those averages, respectively Since the development nature and imprint nature of a toner will change for every color of a toner if the composition of an after-treatment agent differs for every color of a toner, it will be necessary to design development conditions etc. for every color of a toner. Being designed similarly is desirable although you may be the Magenta toner of the above [ a black toner ] for low-cost-izing, a cyano toner and a yellow toner, and the toner of a separate installation meter in this invention.

[0047] It is desirable to the toner 100 weight section 0.05 - 5 weight section and to carry out 0.1-3 weight section addition of the above-mentioned particle preferably. The above-mentioned particle may be used combining it two or more sorts, and those total quantities should just be above-mentioned within the limits in that case.

[0048] The carrier which can use the thing better known than before as a carrier for 2 component developers as a carrier used in order to use the above toners as a 2 component developer, for example, consists of magnetic-substance particles, such as iron and a ferrite, the resin coat carrier which comes to cover such a magnetic-substance particle with a resin, or the binder type carrier which comes to distribute the impalpable powder of a magnetic-substance particle in a binding resin can be used. It is desirable from viewpoints, such as toner SUPENTO, to use the resin coat carrier which used the silicone system resin, the copolymerization resin (graft resin) of organopolysiloxane and a vinyl system monomer, or the polyester system resin as a covering resin also in these carriers, and the carrier which the resin which the isocyanate



was made to react to the copolymerization resin of organopolysiloxane and a vinyl system monomer, and was obtained especially covered is desirable from a viewpoint of endurance, environmental-proof stability, and SUPENTO-proof nature. The monomer which has substituents, such as a hydroxyl group which has an isocyanate and reactivity as the above-mentioned vinyl system monomer, is used preferably. Moreover, as for the volume mean particle diameter of a carrier, it is preferably desirable from high-definition reservation and a viewpoint of carrier fogging prevention to use a 20-60-micrometer thing 20-100 micrometers. [0049] Subsequently, the full color image formation method of this invention is explained. The full color image formation method of this invention is characterized by controlling the maximum coating weight to the recorded material of using a developer which was mentioned above and a Magenta toner, a cyano toner, and a yellow toner to a comparatively small value in the well-known full color image formation method.

[0050] The process developed with the developer which formed the latent image on the electrostatic latent-image support (photo conductor), and mentioned this latent image above in detail, And the process imprinted on a recorded material, without minding the toner image formed on the electrostatic latent-image support through a middle imprint object In the full color image formation method including the toner image which carried out repeatedly for every color of a developer and was imprinted on the recorded material being established the maximum coating weight to the recorded material of a Magenta toner, a cyano toner, and a yellow toner -- respectively -- two or less 5.0 g/m -- desirable -- 2 - 5.0 g/m<sup>2</sup> -- it controls to the value of 3.0 - 4.8 g/m<sup>2</sup> more preferably By using a specific developer in this way in this invention by the specific "maximum coating weight of a toner to a recorded material", it becomes possible to be high-speed and cheap and to offer a high definition full color picture. If the above-mentioned coating weight exceeds 5.0 g/m<sup>2</sup>, since fixing at low temperature will require comparatively high fixing temperature and/or comparatively long time for becoming difficult and attaining sufficient fixing comparatively, improvement in the speed and low-cost-izing of full color image formation cannot be attained simultaneously.

[0051] When using the aforementioned developer above "the maximum coating weight of a toner to a recorded material" in this invention, the complicatedness of the conditioning for every toner at the time of development can be mitigated by making the "maximum coating weight to a recorded material" of a Magenta toner, a cyano toner, and a yellow toner into within the limits of \*\*5% of those averages, respectively. That is, it becomes possible to be high-speed and cheap and to offer a high definition full color picture, mitigating the complicatedness of the conditioning for every toner at the time of development. It becomes possible to be high-speed and cheap and to offer a high definition full color picture, without changing the maximum coating weight of a toner to a recorded material for every toner by controlling further in this invention to the same value of above-mentioned [ the maximum coating weight to the recorded material of a Magenta toner, a cyano toner, and a yellow toner ] within the limits.

[0052] It is desirable to control in this invention like [ the maximum coating weight to the recorded material of a black toner ] the maximum coating weight of a Magenta toner, a cyano toner, and a yellow toner. By controlling such, it is because it becomes possible to be high-speed and cheap and to offer a high definition full color picture still more easily. When for that using carbon black as a coloring matter, it is desirable to fully distribute carbon black.

[0053] In this invention, "the maximum coating weight to the recorded material of a toner" is "a peak of the toner which finally appears on a recorded material", and is one of the conditions beforehand set up for every toner in full color image formation equipment.

[0054] "The maximum coating weight to the recorded material of a toner" is determined as a "peak [ of the toner to which development may adhere at an electrostatic latent-image support ] (henceforth photo conductor maximum coating weight)" row depending on "the imprint efficiency (when not using a middle imprint object) from an electrostatic latent-image support to a recorded material", or "the imprint efficiency and the imprint efficiency (when using a middle

imprint object) from a middle imprint object to a recorded material” from an electrostatic latent-image support to a middle imprint object The photo conductor maximum coating weight is determined by the potential of the picture section in an electrostatic latent-image support and the potential of the non-picture section, the surface potential of a developer support, the distance of an electrostatic latent-image support and a developer support, the magnetism of a carrier, resistance of a carrier, the amount of conveyances of the developer to a developer support top, the peripheral-speed ratio of a developer support and an electrostatic latent-image support, etc.

[0055] Hereafter, the case where a full color picture is formed using the above-mentioned image formation method is explained briefly. First, the photo conductor (electrostatic latent-image support) of a photo conductor drum is uniformly charged with a primary electrification vessel, the laser beam modulated in the Magenta picture signal of a manuscript performs picture exposure, and an electrostatic latent image is formed on a photoconductor drum. Next, after developing this electrostatic latent image with the Magenta development counter which holds the developer containing a Magenta toner and forming a Magenta toner image on a photoconductor drum, this Magenta toner image is imprinted to the conveyed recorded material with an imprint electrification vessel. On the other hand, the photo conductor drum after the Magenta toner image was imprinted is discharged with the electrification vessel for electric discharge, and is cleaned by the cleaning means. After developing after that this electrostatic latent image by the developer which contains formation of electrification with the primary electrification machine of a photo conductor drum, and the electrostatic latent image to photo conductor drum lifting by the picture exposure using the cyano picture signal, and a cyano toner again like the formation method of the above-mentioned Magenta toner image, the cyano toner image to the recorded material with which the above-mentioned Magenta toner image is imprinted is imprinted. Furthermore, formation of a yellow toner image and formation of a black toner image are performed like the formation method of the above-mentioned Magenta toner image one by one, and the color toner picture of four colors is imprinted to a recorded material, and it is established by pressurization and heating according the imprinted full color picture to a fixing roller etc.

[0056] Even if it changes the formation sequence of each color picture, there is especially no problem. Moreover, in the above-mentioned explanation, although the composition which imprints each color toner picture one by one directly to a recorded material was shown, after piling up each color toner picture to middle imprint objects, such as a middle imprint belt, and imprinting one by one to them, you may imprint a superposition picture to a recorded material collectively.

[0057] The full color image formation method of this invention is faced actually carrying out. Since the sensitivity of a photo conductor and the electrification property of a developer may be changed and “the photo conductor maximum coating weight (maximum coating weight to the recorded material of a toner)” may be changed with change of the operating environments (temperature, humidity, etc.) of the equipment which adopted the method concerned, It is desirable to perform automatic concentration control (automatic control of the photo conductor maximum coating weight) about each of the toner of a color with which plurality differs periodically.

[0058] forming a criteria toner image (solid picture) on an electrostatic latent-image support according to predetermined development conditions, and changing suitably strange good development conditions, such as potential of the picture section in an electrostatic latent-image support and potential of the non-picture section, and surface potential of a developer support, with automatic concentration control, based on the coating weight of this criteria toner image -- the value of a convention of the photo conductor maximum coating weight -- an amendment -- they are things

[0059] While a desirable mode smell performs the above-mentioned automatic concentration

control, measures the surface potential of the electrostatic latent-image support charged on condition that predetermined by the surface potential measurement means for every fixed period and makes a storage means memorize the measured value. The last measured value memorized by this measured value and the storage means is compared, when the amount of change is larger than a predetermined value, the aforementioned automatic concentration control is performed, and in being smaller than a predetermined value, it controls to maintain the last development conditions, without performing the aforementioned automatic concentration control. Although the latency time for dozens of seconds will occur by the time the picture of the 1st sheet outputs when performing automatic concentration control, if control according to the amount of change of the surface potential of the above electrostatic latent-image supports is performed, since automatic concentration control with a comparatively small effect will no longer be performed and the number of times of execution of automatic concentration control will be effectively reduced as a result, working capacity improves.

[0060] The 1st mode in which form a criteria toner image about each of the toner of a color with which plurality differs according to the amount of change of the surface potential of the aforementioned electrostatic latent-image support, and development conditions are set up in another desirable mode in case automatic concentration control is performed, A criteria toner image is formed only about the predetermined color of the toners of a color with which plurality differs, development conditions are set up, and the 2nd mode in which the development conditions of other colors are set up is chosen based on the development conditions of this predetermined color. If selection based on the amount of change of the surface potential of such an electrostatic latent-image support is performed, since [ which not necessarily performs automatic concentration control about the toner of all colors / being required ] it is lost and the number of times of execution of automatic concentration control is effectively reduced as a result, working capacity will improve.

[0061] In the method of this invention, aiming at further improvement in working efficiency by adopting combining the two above-mentioned desirable modes, over a long period of time, it is high-speed and cheap and a high definition full color picture can be offered.

[0062]

[Example] (Manufacture of a binder resin (polyester resin)) The alcoholic component and the acid component were put into the four glass mouth flask furnished with the thermometer, the stirrer, the flowing-down formula capacitor, and the nitrogen introduction pipe with the polymerization initiator (dibutyl tin oxide) by the mole ratio shown in Table 1. It was made to react, agitating this at 220 degrees C under nitrogen-gas-atmosphere mind in a mantle heater, and polyester resin A1 and A2 was obtained. The obtained polyester resin had physical properties as shown in Table 1. In addition, EO is front Naka and PO is a polyoxyethylene (2 2) about polyoxypropylene (2 2) -2 and 2-screw (4-hydroxyphenyl) propane. - TPA expresses a terephthalic acid and FA expresses a fumaric acid for 2 and 2-screw (4-hydroxyphenyl) propane.

[0063]

[Table 1]

ポリエステル 樹脂	アルコール成分		酸成分		Mn	Mw/Mn	Tg (℃)	Tm (℃)	酸価 (KOHmg/g)	水酸価 (KOHmg/g)	粉碎性 指数
	PO	EO	FA	TPA							
A1	1.0	10.0	7.0	2.0	3500	3.6	55.4	98.0	4.8	29.1	2.2
A2	10.0	1.0	—	9.0	3900	3.8	64.5	100.2	3.8	27.4	1.8

[0064] (Manufacture of a polymer (B))

- 1.5g of BF3-phenol complexes was dropped in [ small quantity / every ] about 10 minutes,

having taught resin B1 styrene (99.9% of purity) 150g, and toluene 150g to the autoclave, and keeping temperature at 5 degrees C under stirring. Then, stirring was continued for further 3 hours. Next, after rinsing until it separated the water layer and became neutral about polymerized oil further, after having added 50ml of sodium-hydroxide solution 5%, stirring violently for 30 minutes and decomposing a catalyst, an unreacted oil and solvent toluene were distilled off and polystyrene 120g was obtained as a residue. The polymer concerned was used as the resin B1, and physical properties were shown in Table 2.

[0065] – 1.5g of BF<sub>3</sub>-phenol complexes was dropped in [ small quantity / every ] about 10 minutes, having taught 150g / of resin B-2 alpha methyl styrenes / (99.8% of purity), and toluene 150g to the autoclave, and keeping temperature at 5 degrees C under stirring. Then, stirring was continued for further 3 hours. Next, after rinsing until it separated the water layer and became neutral about polymerized oil further, after having added 50ml of sodium-hydroxide solution 5%, stirring violently for 30 minutes and decomposing a catalyst, an unreacted oil and solvent toluene were distilled off and 120g of Polly alpha methyl styrenes was obtained as a residue. The polymer concerned was made into resin B-2, and physical properties were shown in Table 2.

[0066] – 250g [ of resin B3 alpha methyl styrenes ] (99.8% of purity) and isopropenyl toluene 250g and toluene 500g are put into a three-neck flask, and a 3 fluorine boron phenol complex is added small quantity every under churning, and it was made to react at 20 degrees C for 3 hours, cooling by the dry ice acetone bath. Subsequently, added alkali, the catalyst was made to deactivate and it removed, it condensed in order to drive out a solvent and an unreacted monomer, and the alpha-methyl-styrene-isopropenyl toluene copolymer was obtained as a residue. The polymer concerned was used as the resin B3, and physical properties were shown in Table 2.

[0067] – Resin B4 isopropenyl toluene (98% of purity) 200g, 200g [ of alpha methyl styrenes ] (98% of purity), 120g [ of C5 system petroleum fractions obtained by the pyrolysis of petroleum naphtha ] (isoprene), and toluene 500g is put into a three-neck flask, and a 3 fluorine boron phenol complex is added small quantity every under churning, and it was made to react for 3 hours, cooling by the dry ice acetone bath. Next, after having added NaOH solution, agitating violently and decomposing a catalyst, the aqueous phase was separated and the oily polymerization object was obtained. After rinsing a still more nearly oily polymerization object until it became neutral, heating reduced pressure distilling off of an unreacted oil and the solvent was carried out, and the massive white alpha-methyl-styrene-isopropenyl toluene-isoprene copolymer as a residue was obtained. The polymer concerned was used as the resin B4, and physical properties were shown in Table 2.

[0068] – Polystyrene was obtained by the same process as a resin B1 except having made resin B5 reaction time into 2 hours. The polymer concerned was made into resin B5 and physical properties were shown in Table 2.

– The Polly alpha methyl styrene was obtained by the same process as resin B-2 except having made resin B6 reaction time into 4.5 hours. The polymer concerned was made into resin B6 and physical properties were shown in Table 2.

[0069]

[Table 2]

重合体 (B)		Mw	Mn	Mw/Mn	Tg (°C)	粉碎性 指数
B1	ポリスチレン	1500	1000	1.5	62	0.3
B2	ポリ- $\alpha$ -メチルスチレン	2800	1500	1.9	75	0.5
B3	$\alpha$ -メチルスチレン-イソプレネン共重合体	2400	1500	1.6	72	0.5
B4	$\alpha$ -メチルスチレン-イソプレネン共重合体	1900	1100	1.7	65	0.3
B5	ポリスチレン	900	650	1.4	40	0.2
B6	ポリ- $\alpha$ -メチルスチレン	3100	1700	1.8	88	0.7

[0070] (Manufacture of a pigment masterbatch) The pigment used for manufacture of a full color toner was used as a pigment masterbatch obtained by the following methods. The binder resin and pigment which are used in each example or the example of comparison were taught to the pressurized kneader at a rate of the weight ratio (resin : pigment) 7:3, and it kneaded at 120 degrees C for 1 hour. Coarse grinding was carried out with the hammer mill after cooling, and the pigment masterbatch of 30 % of the weight of pigment content was obtained. As a pigment, C.I.Pigment Yellow180 (Hoechst A.G. make), C.I.Pigment Blue 15-3 (Dainippon Ink make), and C.I.Pigment Red 57-1 (Dainippon Ink make) were used.

[0071] After having used toner M1 polyester resin A1 and the pigment masterbatch so that it might become the polyester resin A1;100 weight section and C.I.Pigment Red57-1;5 weight section, carrying out 10 weight sections addition of the resin B1 at this and mixing by the Henschel mixer, melting kneading was carried out by the extruder. coarse grinding after cooling the obtained kneading object -- and it pulverized and the trituration object of 5.5 micrometers of volume mean particle diameters was obtained Then, the trituration object was classified and the toner particle of 6 micrometers of volume mean particle diameters was obtained. After adding the hydrophobic silica (H2000; Hoechst A.G. make) 0.9 weight section, the hydrophobic titanium oxide (particle size of 50nm) 0.9 weight section, and the strontium-titanate (particle-size [ of 350nm ], BET specific surface area9m2/g) 2.0 weight section and carrying out mixed processing by the Henschel mixer to this toner particle 100 weight section, the Magenta toner (M1) was obtained.

[0072] The toner Y1 and C1 pigment masterbatch were changed, and toners Y1 and C1 were obtained by the same process as a toner M1 except having used polyester resin A1 and the pigment masterbatch so that it might become the polyester resin A1;100 weight section and C.I.Pigment Yellow180;8.5 weight section or polyester resin A1;100 weight section, and C.I.Pigment Blue15-3;7 weight section.

[0073] The toner K1 pigment masterbatch was changed into carbon black (mho gal L;;pHby Cabot Corp. 2.5; primary [ an average of ] particle size of 24nm), and the toner K1 was obtained by the same process as a toner M1 except having used polyester resin A1 and carbon black so that it might become the polyester resin A1;100 weight section and the carbon black;8 weight section.

[0074] Toners M2-M12 were obtained by the same process as a toner M1 except having used the pigment masterbatch for the binder resin shown in toner M2 - M12 Table 3 - 5, and the polymer (B) row so that it might become the written toner composition. Toners Y2-Y12 were obtained by the same process as a toner Y1 except having used the pigment masterbatch for the binder resin shown in toner Y2 - Y12 Table 3 - 5, and the polymer (B) row so that it might become the written toner composition.

[0075] Toners C2-C12 were obtained by the same process as a toner C1 except having used

the pigment masterbatch for the binder resin shown in toner C2 – C12 Table 3 – 5, and the polymer (B) row so that it might become the written toner composition.

Toners K2–K12 were obtained by the same process as a toner K1 except having used carbon black for the binder resin shown in toner K2 – K12 Table 3 – 5, and the polymer (B) row so that it might become the written toner composition.

[0076] It used combining the toner shown in Table 3 – 5, and an example and example of comparison each example, or the example of comparison estimated the following items.

[0077] (Productivity) When a mechanical grinder (KTM-0 type : Kawasaki Heavy Industries, Ltd. make) ground a sample (toner constituent (what carried out 2mm mesh path with the feather mill after kneading cooling)) at Throughput F (5 kg/h) and the KTM rotational frequency 12000 (rpm), the load power value W1 when passing the load power value W0 and sample at the time of sample passage nothing was recorded. Then, the volume mean particle diameter D of the pulverization object obtained by KTM pulverization (micrometer) was measured by the multi-sizer II (made in coal tar Beckmann). The grindability index was computed based on the following formula, and it evaluated according to the following ranks. In addition, evaluation was performed about each toner and the average was shown.

Grindability index (H)  $= (D \times (W1 - W0)) / F$  [0078]

O;  $1.0 \leq H < 1.5$ ;

O;  $0.5 \leq H < 1.0$  or  $1.5 \leq H < 2.0$ ;

x;  $H < 0.5$  (too soft) or  $2.0 \leq H$  (too hard).

[0079] (Heat-resistant storage nature) After leaving toner 10g under the elevated temperature of 50 degrees C for 24 hours, the state of aggregation of a toner was observed visually. In addition, evaluation was performed about each toner and the worst result was shown.

O : the aggregate was not seen at all.;

O : although the aggregate existed, it got loose with the weak shock.;

x: The aggregate existed and it did not get loose easily.

[0080] (Electrification nature) The amount of electrifications of each toner was measured by the electric-field separation method. The average was calculated from the amount of electrifications of a Magenta toner, a yellow toner, a cyano toner, and a black toner. The difference of the amount of electrifications of each toner and the average concerned was searched for, and the rate (X (%)) of the difference concerned over the average was searched for. The rate concerned was evaluated according to the following ranks. In addition, evaluation was performed about each toner and the worst result was shown. The carrier used the acrylic denaturation silicone coat ferrite carrier.

O;  $-5 \leq X \leq 5$  (%);

O;  $-10 \leq X < -5$  (%) or  $5 < X \leq 10$  (%);

x;  $X < -10$  (%) or  $10 < X$  (%).

[0081] the following evaluations -- a toner -- an acrylic denaturation silicone coat ferrite carrier and a toner -- 2 component developer prepared and obtained so that a mixing ratio might become 5% of the weight was used

[0082] (Graininess) A Magenta, yellow, cyanogen, and 2 component developer of black were carried in the digital full color copying machine (CF910; Minolta Camera Co., Ltd. make) with which the toner maximum coating weight was set as the value shown in Table 3 – 5, and Society of Electrophotography of Japan chart 1995 No 5-1 was copied.

O; it was better than the graininess of the present product.;

x; it was inferior to the graininess of the present product.

[0083] (Low-temperature fixing nature) A Magenta, yellow, cyanogen, and 2 component developer of black are carried in the digital full color copying machine (CF910; Minolta Camera Co., Ltd. make) with which the maximum coating weight of each toner was set as the value shown in Table 3 – 5, and fixing temperature is set in the range of 120 degrees C – 170 degrees C. 1.5cmx1.5cm 3 color superposition picture (a Magenta toner, a yellow toner, and cyano toner)

was printed making it change by 2-degree-C serration. The picture was bent from middle to two and viewing estimated the detachability of the picture. Temperature between the fixing temperature when a picture bending and exfoliating to the section circumference and fixing temperature when a picture bends and only the section exfoliates was made into fixing minimum temperature.

O; fixing minimum temperature was less than 145 degrees C.;

O; fixing minimum temperature was 145 degrees C or more less than 155 degrees C.;

\*\*; fixing minimum temperature was 155 degrees C or more less than 165 degrees C.;

(practically with no problem)

x; fixing minimum temperature was 165 degrees C or more (practically those with a problem).

[0084]

[Table 3]

	粒径 (μm)	トナー組成			付着量 (g/㎡)	評価				
		バインダー 樹脂	重合体(B) 種/部*	着色剤** 使用量(部)		生産性	耐熱 保管性	粒状性	帯電性	低温 定着性
実施例1	トナーM1	6	A1	B1/10	4.5	◎	○	○	◎	◎
	トナーY1	6	A1	B1/10						
	トナーC1	6	A1	B1/10						
	トナーK1	6	A1	B1/10						
実施例2	トナーM2	6	A1	B2/10	4.5	◎	◎	○	◎	○
	トナーY2	6	A1	B2/10						
	トナーC2	6	A1	B2/10						
	トナーK2	6	A1	B2/10						
実施例3	トナーM3	6	A1	B3/10	4.5	◎	◎	○	○	○
	トナーY3	6	A1	B3/10						
	トナーC3	6	A1	B3/10						
	トナーK3	6	A1	B3/10						
実施例4	トナーM4	6	A1	B4/10	4.5	◎	○	○	○	◎
	トナーY4	6	A1	B4/10						
	トナーC4	6	A1	B4/10						
	トナーK4	6	A1	B4/10						
実施例5	トナーM5	6	A1	B1/5	4.5	○	○	○	○	◎
	トナーY5	6	A1	B1/5						
	トナーC5	6	A1	B1/5						
	トナーK5	6	A1	B1/5						

\*バインダー樹脂100重量部に対する重合体 (B) の使用量を示す。

\*\*バインダー樹脂100重量部に対する着色剤の使用量を示す。

[0085]

[Table 4]



		粒径 ( $\mu\text{m}$ )	トナー組成			付着量 ( $\text{g}/\text{m}^2$ )	評価			
			バインダー 樹脂	重合体(B) 種/部*	着色剤** 使用量(部)		生産性	耐熱 保管性	粒状性	帯電性
実施例6	トナーM6	5	A1	B1/10	6.5	3.5	◎	○	○	◎
	トナーY6	5	A1	B1/10	11					
	トナーC6	5	A1	B1/10	9					
	トナーK6	5	A1	B1/10	8					
実施例7	トナーM7	6	A2	B1/10	5	4.5	◎	○	○	◎
	トナーY7	6	A2	B1/10	8.5					
	トナーC7	6	A2	B1/10	7					
	トナーK7	6	A2	B1/10	8					
比較例1	トナーM8	6	A1	—/0	5	4.5	×	×	○	×
	トナーY8	6	A1	—/0	8.5					
	トナーC8	6	A1	—/0	7					
	トナーK8	6	A1	—/0	8					
比較例2	トナーM9	6	A1	B1/25	5	4.5	×	○	○	◎
	トナーY9	6	A1	B1/25	8.5					
	トナーC9	6	A1	B1/25	7					
	トナーK9	6	A1	B1/25	8					
比較例3	トナーM10	8	A1	B1/10	3.5	7	◎	○	×	◎
	トナーY10	8	A1	B1/10	6					
	トナーC10	8	A1	B1/10	5.3					
	トナーK10	8	A1	B1/10	8					

\*バインダー樹脂100重量部に対する重合体 (B) の使用量を示す。

\*\*バインダー樹脂100重量部に対する着色剤の使用量を示す。

[0086]

[Table 5]

	粒徑 (μm)	トナー組成			付着量 (g/m <sup>2</sup> )	評価				
		バインダー 樹脂	重合体(B) 種/部*	着色剤** 使用量(部)		生産性	耐熱 保管性	粒状性	帯電性	低温 定着性
比較例4	トナーM11	6	A1	B5/10	4.5	◎	×	○	×	◎
	トナーY11	6	A1	B5/10						
	トナーC11	6	A1	B5/10						
	トナーK11	6	A1	B5/10						
比較例5	トナーM12	6	A1	B6/10	4.5	○	◎	○	×	△
	トナーY12	6	A1	B6/10						
	トナーC12	6	A1	B6/10						
	トナーK12	6	A1	B6/10						

\*バインダー樹脂100重量部に対する重合体 (B) の使用量を示す。

\*\*バインダー樹脂100重量部に対する着色剤の使用量を示す。

[0087] (Manufacture of an acrylic denaturation silicone coat ferrite) It is 100 weight \*\*\*\*\* about a methyl ethyl ketone at a flask with an equipped with a stirrer, a capacitor, a thermometer, a nitrogen introduction pipe, and dropping equipment capacity of 500ml. Under nitrogen-gas-atmosphere mind, at 80 degrees C, the solution which was made to dissolve the methyl methacrylate 86.7 weight section, 2-hydroxyethyl methacrylate 5.1 weight section, 3-methacryloxypropyl tris (trimethylsiloxy) silane 58.2 weight section and 1, and 1'-azobis (cyclohexane-1-carbonitrile) 1 weight section in the methyl-ethyl-ketone 100 weight section, and was obtained was dropped into the reactor over 2 hours, and was ripened for 5 hours. after

adjusting isophorone diisocyanate / trimethylol-propane adduct (IPDI/TMP system : NCO%=6.1%) as a cross linking agent to the obtained resin so that the OH/NCO mole fraction may become 1/1 -- a methyl ethyl ketone -- diluting -- a fixed ratio -- the coat resin solution which is 8 % of the weight was prepared

[0088] Using the baking ferrite powder F-800 (volume mean particle diameter : micrometers [ 50 ], Powdertech make) as core material, the above-mentioned coat resin solution was applied and dried with Spira Cota (Okada elaborate company make) so that the amount of covering resins to core material might become 1.5% of the weight. In hot blast circulating oven, at 160 degrees C, the obtained carrier was left for 1 hour and calcinated. The ferrite powder bulk after cooling was cracked using the sieve shaker which attached 106 micrometers of openings, and a 75-micrometer screen mesh, and the acrylic denaturation silicone coat ferrite carrier was obtained.

[0089] (others -- measuring method)

- Temperature which flows out of the defluxion start point when carrying out melting defluxion of the sample of 3 1cm on condition that the pore (the path of 1mm, a length of 1mm) of a dice, pressurization 30 kg/cm<sup>2</sup>, and 3 degrees C of programming rates and min using the measuring method flow tester (CFT-500:Shimadzu Corp. make) of the softening temperature T<sub>m</sub> of a resin, and is equivalent to one half of the height of an ending point was made into softening temperature.

- The acid number is the value which dissolved the 10mg sample in toluene 50ml, titrated using the mixed indicator of 0.1% of bromthymol blue, and a Phenol Red with N / 10 potassium hydroxides / alcoholic solution by which standardization was carried out beforehand, and was computed from the consumption of N / 10 potassium hydroxides / alcoholic solution.

[0090] - The particle size of a toner was measured using the coal tar multi-sizer II.

- The mean particle diameter of an inorganic particle was observed with the transmission electron microscope (JEM-1010 type; the JEOL datum company make), measured the diameter of 100 particles, and asked for the mean particle diameter.

[0091]

[Effect of the Invention] By this invention, it is high-speed and cheap and a high definition full color picture can be offered.

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[Translation done.]

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**JAPANESE** [JP,2002-131973,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE  
INVENTION TECHNICAL PROBLEM MEANS EXAMPLE

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**TECHNICAL FIELD**

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**[The technical field to which invention belongs] this invention relates to the full color image formation method.**

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**[Translation done.]**

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**[Translation done.]**



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**PRIOR ART**

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[Description of the Prior Art] Generally, the full color image formation method forms a latent image on an electrostatic latent-image support (photo conductor), and comes to contain the process (development process) which develops this latent image with a toner, the process (imprint process) imprinted on a recorded material, without minding the toner image formed on the electrostatic latent-image support through a middle imprint object, and the process (fixing process) established in the toner image on a recorded material. After developing negatives for every color and piling up a toner layer on a recorded material in detail using the toner of four colors of a Magenta color, a yellow color, a cyano color, and a black color, a toner layer is established by pressurization and heating. It is common in a binder resin, a coloring agent, etc. coarse grinding melting and after kneading and cooling, and to pulverize, to classify by request and to obtain the toner used for such an image formation method at least.

[0003] In recent years, in the field of the above full color image formation methods, improvement in the speed and low-cost-izing of image formation are demanded of the high definition-ized row of a picture, and various attempts are made about the image formation process and the toner.

[0004] For example, in order to attain high definition-ization of a picture, it is known that it is effective to make the mean particle diameter of a toner small. However, since the specific surface area of a toner increased by minor diameter-ization of a toner, there was an inclination for the amount of toner electrifications per unit weight to become high. When the amount of electrifications became high too much, the problem that the amount of development was restricted and desired picture concentration was not obtained arose. Then, in order to prevent the fall of picture concentration, in JP,9-114127,A, the attempt which specifies the volume mean particle diameter of a toner, a color-material content, and the toner weight of the solid section on tracing paper is made. According to this convention, also in the diameter toner of a granule, desired picture concentration is securable by raising a color-material content. However, if a color-material content was raised, since the electric charge nature of a toner would be greatly influenced by the electric charge performance which color material has, the maximum coating weight of development conditions and a toner [ especially as opposed to a recorded material ] needed to be changed comparatively greatly for every toner. If the difference of the maximum coating weight of a toner to the recorded material for every toner is too large, the conditioning for every toner at the time of development is complicated, and improvement in the speed and low-cost-izing of full color image formation cannot be attained. Moreover, the amount of electrifications needed to be adjusted with material other than color material for every toner at the time of toner manufacture.

[0005] Moreover, in the manufacturing process of a ground type toner, although the pulverizing process had required the long time comparatively, it was difficult for pulverizing to take a long time further to minor diameter-ization of a toner, and for productivity to fall, and to attain low-cost-ization as a result. Then, the technology of making the toner constituent before

kneading containing a specific petroleum resin, and raising the grindability of a toner constituent is reported by JP,11-65161,A. Here, in order to secure the preservation stability of a toner as a binder resin, a resin 60 degrees C or more is used for a glass transition point. However, when the toner by the technology concerned was used, fixing took the long time comparatively, and improvement in the speed of full color image formation was not attained.

[0006] In order to attain improvement in the speed of full color image formation, increasing the color-material content of a toner and reducing the coating weight of a toner to a recorded material and lowering the melting start temperature of a toner binder resin are proposed. However, if the coating weight of a toner was reduced, in order that the number of composition toners per pixel might decrease, there was a problem that the graininess of the picture acquired got worse. That is, the coarse picture of a texture was acquired. Moreover, when the binder resin with comparatively low melting start temperature was used, there was a problem that toner condensation tends to take place. That is, when a toner was comparatively saved under an elevated temperature, condensation took place, and condensation took place by churning into the development counter.

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**EFFECT OF THE INVENTION**

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[Effect of the Invention] By this invention, it is high-speed and cheap and a high definition full color picture can be offered.

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**TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention] this invention is made in view of the above-mentioned situation, and it aims at offering the full color image formation method that it is high-speed and cheap and a high definition full color picture can be offered.

[0008] Even if this invention does not change the maximum coating weight of a toner to a recorded material for every toner, it aims at offering the full color image formation method that it is high-speed and cheap and a high definition full color picture can be offered again.

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**MEANS**

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[Means for Solving the Problem] The process which this invention forms a latent image on an electrostatic latent-image support, and develops this latent image with a developer, And the process imprinted on a recorded material, without minding the toner image formed on the electrostatic latent-image support through a middle imprint object It is the full color image formation method including the toner image which carried out repeatedly for every color of a developer and was imprinted on the recorded material being established. The Magenta developer which contains a Magenta toner as a developer, the cyano developer containing a cyano toner, While each toner has 3-7.5 micrometers of volume mean particle diameters using the yellow developer containing a yellow toner, and the black developer containing a black toner at least -- a binder -- a resin -- 100 -- a weight -- the section -- weight average molecular weight -- 1000 - 3000 -- and -- weight average molecular weight -- /-- number average molecular weight -- 2.0 -- less than -- a polymer -- (-- B --) -- one - 20 -- a weight -- the section -- and -- a coloring agent -- containing -- becoming -- It is related with the full color image formation method characterized by controlling the maximum coating weight to the recorded material of a Magenta toner, a cyano toner, and a yellow toner to the value of two or less [ 5.0g //m ], respectively.

[0010] When the specific polymer (B) was used, even if he made the toner the diameter of a granule and filled up this toner with comparatively a lot of coloring agents, the artificer of this invention etc. found out that the difference of the electrification level between the toners of each color was reduced, and found out that the purpose of this invention was attained easily by using still such a toner on specific development conditions.

[0011]

[Embodiments of the Invention] The developer used for the method of this invention may be 2 component developer which mixes a toner and a carrier and is obtained, or may be 1 component developer which uses a toner independently. Moreover, although used combining the Magenta developer which contains a Magenta toner as a developer in this invention, the cyano developer containing a cyano toner, the yellow developer containing a yellow toner, and the black developer containing a black toner, as long as it is not limited to this and can form a full color picture, you may use combining the developer of other colors.

[0012] Hereafter, although a toner is explained first, unless it mentions specially, the following explanation may be applied independently to a Magenta toner, a cyano toner, a yellow toner, and a black toner, respectively.

[0013] The toner used in this invention comes to contain a binder resin, a specific polymer (B), and a coloring agent at least. In order to use a specific polymer (B) which is explained in full detail in this invention later, a toner has the composition which the polymer (B) exposed to the particle front face. Since a toner has such composition, even if it fills up with comparatively a lot of coloring agents, the probability that a coloring agent will be exposed to the particle front face of a toner is considered that it decreases notably and the difference of the electrification



level between the toners of each color based on the difference in the electrification performance of each coloring agent is reduced. Moreover, since a toner has the above composition, the effect that toner condensation stops being able to happen easily is also acquired. The effect that the productivity of a toner improves is also acquired by furthermore using a polymer (B).

[0014] If a polymer (B) is used in manufacture of a toner, in a kneading process, a polymer (B) is distributed as a particle in a binder resin, and since it is ground while a trituration side is formed so that a kneading object may connect the particulate material of a polymer (B) with a trituration process, it will be thought that the toner which has the composition which the polymer (B) exposed to the particle front face is obtained. In detail, in the place where the polymer (B) particle in a kneading object exists, since trituration takes place not through the contact surface (interface) of a binder resin and a polymer (B) particle but through the interior of a polymer (B) particle, the trituration side concerned is constituted by the polymer (B) and it is thought that a polymer (B) is exposed to a particle front face as a result.

[0015] the polymer (B) used in this invention -- weight average molecular weight ( $M_w$ ) -- 1000-3000 -- 1000-2800, and weight average molecular weight/number average molecular weight ( $M_w/M_n$ ) are 1.9 or less preferably 2.0 or less If such a polymer (B) is not used, the toner of composition of having exposed to the particle front face cannot be obtained, but the difference of the electrification level between the toners of each color will need to become comparatively large, and a polymer (B) will need to change the maximum coating weight comparatively greatly for every toner, and will become complicated [ the conditioning for every toner at the time of development ]. Furthermore, since the glass transition point of a polymer (B) becomes it low that  $M_w$  of a polymer (B) is less than 1000, the storage nature (heat-resistant storage nature) when leaving a toner at comparatively high temperature gets worse, and use becomes difficult practically. On the other hand, if  $M_w$  exceeds 3000, the own grindability of this material will become bad and the improvement effect of the grindability by using this material will no longer be accepted.

[0016]  $M_w$  and  $M_n$  of a polymer or a resin use the value measured by the gel permeation chromatography (807-IT type; Japan a spectrum industrial company make) among this specification. In detail, the column was kept at 40 degrees C, and 30mg of samples which pass and measure a tetrahydrofuran by 10 kg/cm<sup>3</sup> as a carrier solvent was dissolved in tetrahydrofuran 20ml, and 0.5mg of this solution was introduced with the above-mentioned carrier solvent, and it asked for it by polystyrene conversion.

[0017] As for such a polymer (B), it is preferably desirable the grindability indices 0.1-1.0 and to have 0.2-0.6. A grindability index is one index of it being ground and expressing easy, and means that it is easy to be ground, so that the value concerned is small.

[0018] The grindability index uses the value measured according to the following among this specification. In case a mechanical grinder (KTM-0 type : Kawasaki Heavy Industries, Ltd. make) grinds the sample of about 2mm of volume mean particle diameters at Throughput F (5 kg/h) and the KTM rotational frequency 12000 (rpm), the load power value  $W_1$  when passing the load power value  $W_0$  and sample at the time of sample passage nothing is recorded. Then, the volume mean particle diameter  $D$  of the trituration object obtained by KTM trituration (micrometer) is measured by the coal tar multi-sizer II (made in coal tar Beckmann). Based on the following formula, a grindability index is computed from the acquired value.

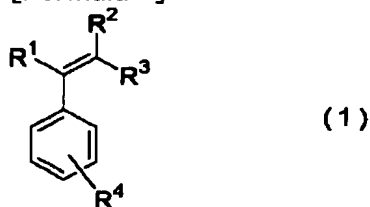
Grindability index =  $(D \times (W_1 - W_0)) / F$  [0019] Moreover, as for the glass transition point ( $T_g$ ) of a polymer (B), it is preferably desirable from the viewpoint of the further improvement in heat-resistant storage nature and low-temperature fixing nature that it is 60-80 degrees C more preferably 55-85 degrees C 50 degrees C or more. Among this specification, using the differential scanning calorimeter (DSC-200; SEIKO electronic company make), the glass transition point of a polymer or a resin uses a reference as an alumina, measures a 10mg sample among 20-120 degrees C on condition that 10 degrees C of programming rates, and min, and

makes the shoulder value of a main endothermic peak the glass transition point.

[0020] As long as it does not dissolve as a kind of polymer (B) even if melting kneading of the polymer (B) is carried out with a binder resin, and a binder resin differs from a grindability, it is not restricted, for example, the homopolymer or copolymer of a well-known aromatic monomer and/or an aliphatic monomer can be used. It means that "a binder resin differs from a grindability" has [ 0.5 or more / 0.7 or more ] the grindability index of a polymer (B) preferably smaller than the grindability index of a binder resin here. By using the polymer (B) and binder resin which have the relation of such a grindability index, a polymer (B) can obtain effectively the toner exposed to the front face.

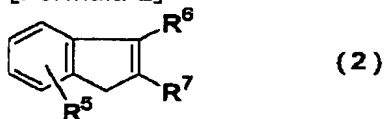
[0021] As an aromatic monomer, it is a general formula (1);

[Formula 1]



It is [ the styrene system monomer expressed with (R1, R2, R3, and R4 being a hydrogen atom, a halogen atom or the alkyl group of carbon numbers 1-4, for example, a methyl group, an ethyl group, n-propyl group, and n-butyl independently among a formula, respectively, and being a hydrogen atom, a chlorine atom, a bromine atom, or a methyl group preferably), and ] a general formula (2);

[Formula 2]



The indene system monomer expressed with (R5, R6, and R7 being a hydrogen atom, a halogen atom or the alkyl group of carbon numbers 1-6, for example, a methyl group, an ethyl group, n-propyl group, n-butyl, n-pentyl machine, and n-hexyl machine independently among a formula, respectively, and being a hydrogen atom, a chlorine atom, a bromine atom, or a methyl group preferably) is mentioned.

[0022] As an example of a styrene system monomer, for example Styrene, vinyltoluene, An alpha methyl styrene, isopropenyl toluene, beta-methyl styrene, 1-propenyl toluene, o-chloro styrene, m-chloro styrene, p-chloro styrene, alpha-chloro styrene, beta-chloro styrene, o-bromostyrene, m-bromostyrene, p-bromostyrene, alpha-bromostyrene, beta-bromostyrene, etc. are mentioned. Preferably Styrene, vinyltoluene, an alpha methyl styrene, isopropenyl toluene, beta-methyl styrene and 1-propenyl toluene -- more -- desirable -- styrene, vinyltoluene, an alpha methyl styrene, and isopropenyl toluene -- they are styrene, an alpha methyl styrene, and isopropenyl toluene still more preferably As an example of an indene system monomer, for example, an indene, a methyl indene, an ethyl indene, etc. are mentioned, and especially an indene is desirable also in these. In this case, it is desirable when using a pure monomer with high purity stops coloring of a resin, an odor, and the amount of VOC(s) low. An aromatic monomer is independent, or may be combined and used.

[0023] As an example of an aliphatic monomer, especially if the above-mentioned aromatic monomer and a polymerization are possible, it will not be restricted. For example, an isoprene, a piperylene, 1,3-butadiene, 1, 3-pentadiene, 1, 5-hexadiene, 2, 3-dimethyl-1,3-butadiene, a chloroprene, Diolefin system monomers, such as 2-BUROMO-1,3-butadiene; Ethylene, A propylene, a butylene, an isobutylene, 2-methyl-butene-1, the monoolefin system monomer of 2-methylbutene-2 grade; A methyl acrylate, An ethyl acrylate, an acrylic-acid n-propyl, an

acrylic-acid isopropyl, Acrylic-acid n-butyl, isobutyl acrylate, acrylic-acid t-butyl, An acrylic-acid n-pentyl, an acrylic-acid isopentyl, acrylic-acid neopentyl, Acrylic-acid 3-(methyl) butyl, an acrylic-acid hexyl, an acrylic-acid octyl, Acrylic-acid alkyl ester system monomers, such as an acrylic-acid nonyl, an acrylic-acid desyl, an acrylic-acid undecyl, and an acrylic-acid dodecyl; A methyl methacrylate, An ethyl methacrylate, a methacrylic-acid n-propyl, a methacrylic-acid isopropyl, Methacrylic-acid n-butyl, a methacrylic-acid isobutyl, methacrylic-acid t-butyl, A methacrylic-acid n-pentyl, a methacrylic-acid isopentyl, methacrylic-acid neopentyl, Methacrylic-acid 3-(methyl) butyl, a methacrylic-acid hexyl, a methacrylic-acid octyl, A methacrylic-acid nonyl, a methacrylic-acid desyl, a methacrylic-acid undecyl, Alkyl methacrylate ester system monomers, such as a methacrylic-acid dodecyl; An acrylic acid, Unsaturated-carboxylic-acid system monomers, such as a methacrylic acid, an itaconic acid, and a maleic acid; Acrylonitrile, A maleate, itaconic-acid ester, a vinyl chloride, vinyl acetate, a benzoic-acid vinyl, a vinyl methyl ethyl ketone, a vinyl hexyl ketone, a vinyl methyl ether, vinyl ethyl ether, the vinyl isobutyl ether, etc. are mentioned. It is a monoolefin system monomer and a diolefin system monomer preferably, and is an isoprene preferably [ it is more desirable and ] to an isoprene, a piperylene, 2-methyl-butene-1, the 2-methylbutene -2, and a pan. A \*\*\*\* monomer is independent, or may be combined and used.

[0024] The homopolymer or copolymer of the aromatic monomer and/or aliphatic monomer whose aliphatic monomer an aromatic monomer is 1 or the monomer beyond it chosen from the group which consists of styrene, an alpha methyl styrene, and isopropenyl toluene, and is an isoprene also in the polymer (B) which consists of the above monomers is desirable.

[0025] What was compounded considering the diolefin and/or monoolefin which are contained in the decomposition oil fraction by which the byproduction was carried out as such a desirable polymer (B) from the plant which manufactures ethylene, a propylene, etc. by steam cracking of petroleum as a raw material may be used preferably.

[0026] Moreover, they are polystyrene and the Polly alpha methyl styrene preferably from a viewpoint which a polystyrene, Polly alpha-methyl-styrene, and styrene-alpha-methyl-styrene copolymer, an alpha-methyl-styrene-isopropenyl toluene copolymer, a styrene-isopropenyl toluene copolymer, an alpha-methyl-styrene-isopropenyl toluene-isoprene copolymer, a styrene-isopropenyl toluene-isoprene copolymer, etc. are mentioned, and reduces further the difference of the electrification level between the toners of each color as an example of the above desirable polymers (B).

[0027] When using polystyrene as a polymer (B), as for the weight average molecular weight, it is still more desirable that it is 1000-2000. Moreover, when using the Polly alpha methyl styrene as a polymer (B), as for the weight average molecular weight, it is still more desirable that it is 2000-2800.

[0028] the amount of the polymer (B) used -- the binder resin 100 weight section -- receiving -- 1 - 20 weight section -- it is 3 - 15 weight section preferably If there is too little amount used, the improvement effect of the grindability of a toner constituent will be hard to be acquired. When there is too much amount used, a toner becomes that overgrinding is easy to be carried out, and there is an inclination for toner particle size to change a lot in a development counter.

[0029] It is not restricted especially as a binder resin, but well-known synthetic resin or well-known natural resin can be used in the field of the toner for electrostatic-charge image development. For example, a polyester system resin, a styrene resin, a polyvinyl chloride, phenol resin, natural denaturation phenol resin, natural denaturation maleic resin, an acrylic resin, an methacrylic system resin, polyvinyl acetate, silicone resin, polyurethane, polyamide resin, a furan resin, an epoxy resin, a xylene resin, a polyvinyl butyral, a terpene resin, a cumarone indene resin, etc. are mentioned. Preferably, the polyester system resin which made a polyester system resin or styrene-acrylic resin graft-ize is mentioned. In this invention, it is more desirable to use a polyester system resin from a viewpoint of the further improvement in low-temperature fixing

nature.

[0030] Although specifying the softening temperature of a binder resin as a means which raises the low-temperature fixing nature of a toner from the former was often performed, in this invention, it found out that the direction of a glass transition point correlated with low-temperature fixing nature well from the softening temperature of a binder resin. Therefore, as for a binder resin, in this invention, it is desirable for 45–65 degrees C of the viewpoint of the further improvement in heat-resistant storage nature and low-temperature fixing nature to glass transition points to be 50–60 degrees C preferably. In addition, as for the softening temperature of a binder resin, it is desirable that it is 120 degrees C or less from the color-reproduction nature and the glossy viewpoint of a full color picture.

[0031] The polyester resin obtained by carrying out the polycondensation of a polyhydric-alcohol component and the multiple-valued carboxylic-acid component as a polyester system resin in this invention is usable. Among polyhydric-alcohol components, as a dihydric alcohol component For example, polyoxypropylene (2 2) –2, 2-screw (4-hydroxyphenyl) propane, Polyoxypropylene (3 3) –2, 2-screw (4-hydroxyphenyl) propane, Polyoxypropylene (6) –2, 2-screw (4-hydroxyphenyl) propane, A polyoxyethylene (2 0) –2, 2-screw (4-hydroxyphenyl) propane, The bisphenol A alkylene oxide addition products, such as a polyoxyethylene (2 2) –2 and 2-screw (4-hydroxyphenyl) propane, Ethylene glycol, a diethylene glycol, a triethylene glycol, 1, 2-propylene glycol, 1, 3-propylene glycol, 1, 4-butanediol, Neopentyl glycol, 1, 4-butene diol, 1,5-pentanediol, 1, 6-hexandiol, 1, 4-cyclohexane dimethanol, a dipropylene glycol, a polyethylene glycol, a polytetramethylene glycol, bisphenol A, hydrogenation bisphenol A, etc. are mentioned. As an alcoholic component more than trivalent, they are a sorbitol, 1, 2 and 3, 6-hexane tetrol, 1, 4-sorbitan, a pentaerythritol, dipentaerythritol, tripentaerythritol, 1 and 2, 4-butane triol, 1 and 2, 5-pentanetriol, a glycerol, isobutane triol, and 2-methyl, for example. – 1, 2, 4-butane triol, trimethylolethane, a trimethylol propane, 1 and 3, 5-trihydroxy methylbenzene, etc. are mentioned.

[0032] Moreover, as a divalent carboxylic-acid component, the anhydride or low-grade alkyl ester of a maleic acid, a fumaric acid, a citraconic acid, an itaconic acid, a glutaconic acid, a phthalic acid, an isophthalic acid, a terephthalic acid, a cyclohexane dicarboxylic acid, a succinic acid, an adipic acid, sebacic acid, an azelaic acid, a malonic acid, an n-dodecenyl succinic acid, an iso dodecenyl succinic acid, n-dodecyl succinic acid, an iso dodecyl succinic acid, n-OKUTE nil succinic acid, an iso OKUTE nil succinic acid, n-octyl succinic acid, iso octyl succinic acids, and

[0033] As a carboxylic-acid component more than trivalent, for example 1, 2, 4-benzene tricarboxylic acid (trimellitic acid), 1, 2, 5-benzene tricarboxylic acid, 2 and 5, 7-naphthalene tricarboxylic acid, 1 and 2, 4-naphthalene tricarboxylic acid, 1, 2, 4-butane tricarboxylic acid, 1 and 2, 5-hexane tricarboxylic acid, 1 A 3-dicarboxyl-2-methyl-2-methylene carboxy propane, The anhydride of 1, 2, 4-cyclohexane tricarboxylic acid, tetrapod (methylene carboxyl) methane, 1, 2 and 7, 8-octane tetracarboxylic acid, pyromellitic acid, en pole trimer acids, and these acids, low-grade alkyl ester, etc. are mentioned.

[0034] The polyester resin obtained considering at least one sort chosen from the group which makes a principal component the bisphenol A alkylene oxide addition product as a polyhydric-alcohol component, and consists of a terephthalic acid, a fumaric acid, a dodecenyl succinic acid, and a benzene tricarboxylic acid as a multiple-valued carboxylic-acid component also in the polyester resin which consists of the above monomer components as a principal component is desirable.

[0035] The polyester resin obtained from a viewpoint of the further improvement in low-temperature fixing nature, using a terephthalic acid and a fumaric acid as a multiple-valued carboxylic-acid component, using polyoxypropylene (2 2) –2, 2-screw (4-hydroxyphenyl) propane (it being called "PO") and a polyoxyethylene (2 2) –2, and 2-screw (4-hydroxyphenyl) propane (it being called "EO") as a polyhydric-alcohol component is desirable. At this time, it is

still more desirable than PO to use many EO(s) and to use many fumaric acids rather than a terephthalic acid. It is for making it a glass transition point not become high too much, maintaining a desired grindability index.

[0036] When using the above polyester resin as a binder resin, as for the acid number, it is preferably desirable that it is 3 – 20 KOHmg/g three to 30 KOHmg/g. While raising the dispersibility of the pigment which contains carbon black by using the polyester resin of such the acid number, or an electrification control agent, the toner which has more sufficient amount of electrifications can be obtained.

[0037] In order to control the glossiness of a picture in the full color toner which the fixing nature as a toner for heat roller fixing and offset-proof nature are raised especially in this invention, and needs a translucency, you may use two kinds of polyester resin from which softening temperature differs as polyester resin. At this time, the acid number of those mixed resins should just be above-mentioned within the limits.

[0038] As a coloring agent used by this invention, the well-known pigment and well-known color which are used as a coloring agent for full color toners from the former are usable. For example, carbon black, activated carbon, titanium black, aniline blue, Cull coil blue, chrome yellow, ultra marine blue, E. I. du Pont de Nemours oil red, Quinoline yellow, methylene-blue chloride, a copper phthalocyanine, a Malachite-Green OKISA rate, Lamp black, a rose bengal, C. I. pigment red 48: 1, the C.I. pigment red 122, the C.I. pigment red 57:1, the C.I. pigment red 184, the C.I. pigment yellow 12, the C.I. pigment yellow 17, the C.I. pigment yellow 93, C. I. pigment yellow 97, the C.I. pigment yellow 109, C.I. pigment yellow 110, the C.I. pigment yellow 155, the C.I. pigment yellow 180, C.I. pigment yellow 185, C. I. solvent yellow 162, the C.I. pigment blue 15:1, and C.I. pigment blue 15:3 grade can be mentioned. In a black toner, you may replace some or all of a coloring agent, such as various carbon black, activated carbon, and titanium black, with the magnetic substance. As the magnetic substance, well-known magnetic-substance particles, such as a ferrite, a magnetite, and iron, are usable, for example. The mean particle diameter of a magnetic particle has especially preferably desirable 0.5 micrometers or less 1 micrometer or less in the meaning which acquires the dispersibility at the time of manufacture. the case where the magnetic substance is added in viewpoints, such as scattering prevention, giving the property as a nonmagnetic toner to a toner -- the addition -- the binder resin 100 weight section -- receiving -- 0.5 – 10 weight section -- desirable -- 0.5 – 8 weight section -- it is 1 – 5 weight section more preferably

[0039] Although the content of a coloring agent should just be suitably determined according to the hiding power of a coloring agent, and the maximum coating weight at the time of image formation, even if it is filled up with comparatively a lot of coloring agents in this invention, since the electrification nature of the toner of each color hardly changes, using comparatively mostly is more effective. For example, when the maximum coating weight of a toner to a recorded material is 4 g/m<sup>2</sup>, the range of 6.5 – 12 weight section and the C.I. pigment blue 15:3 are used [ the C.I. pigment red 57:1 ] for the range of 4 – 8 weight section, and the C.I. pigment yellow 180 in the range of 5.5 – 10 weight section (criteria are the binder resin 100 weight section). In addition, as for the coloring agent used for the toner of a Magenta, cyanogen, and yellow, it is desirable to be used as a masterbatch ground and obtained, after carrying out melting kneading beforehand with the binder resin used, and the amount of [ at that time used ] should just become above-mentioned [ the coloring agent content in the toner obtained ] within the limits.

[0040] You may make a toner contain an electrification control agent and a release agent by request. As an electrification control agent for a Magenta toner, a cyano toner, and yellow toners, the electrification control agent of the colorlessness which does not have a bad influence on the color tone of a color toner and a translucency, white, or light color is usable, for example, the zinc of salicylic acid derivatives, the metal complex of chromium, a calyx arene system compound, an organic boron compound, a fluorine-containing quaternary-ammonium-salt system compound, etc. are used suitably. As the above-mentioned

salicylic-acid metal complex, a thing with a thing given [ as an organic boron compound ] in JP,2-221967,A with a thing [ given in JP,53-127726,A, JP,62-145255,A, etc. ] given [ as a calyx arene system compound ] in JP,2-201378,A etc. is usable.

[0041] A wax is used as a release agent. As a wax, a well-known wax is usable in the field of the toner for electrostatic-charge image development, for example, a polyethylene wax, a polypropylene wax, carnauba wax, a rice wax, a SAZORU wax, a montan ester wax, the Fischer Tropsch wax, paraffin wax, etc. can be mentioned. Desirable especially as for the melting point of a desirable wax, it is 50-90 degrees C to use the wax of the low melting point from a viewpoint of the further improvement in low-temperature fixing nature and improvement in the separability from a fixing roller. The addition of a release agent has desirable 0.5 - 5 weight section to the binder resin 100 weight section.

[0042] It faces obtaining a toner, and first, after mixing other additives, for example, a release agent, an electrification control agent, etc. with well-known mixed equipments, such as a Henschel mixer, in a binder resin, an above-mentioned polymer (B), and an above-mentioned coloring agent row, with well-known kneading equipment, melting kneading is carried out, it cools and a kneading object is obtained. Subsequently, a kneading object is ground and classified and carries out momentary heat-treatment by request. Finally in this invention, 3-7.5 micrometers of volume mean particle diameters of a toner particle are 4-6.5 micrometers preferably. If particle size is too small, by increase of the surface area of a toner, the adhesion force between toners will be too high, and the condensation at the time of the time of storage and supply, and development will serve as a technical problem. If particle size is too large, level of graininess (fineness of a texture) required as a full color picture cannot be attained. As equipment for performing momentary heat-treatment, a SAFUYUJINGU system (Japanese pneumatic industrial company make) is usable, for example.

[0043] To a toner, it is desirable to add various organic one / inorganic particle (after-treatment agent) for the purpose of grant of a fluidity or cleaning nature. As a non-subtlety particle, for example Silicon carbide, a boron carbide, a titanium carbide, A zirconium carbide, a hafnium carbide, a vanadium carbide, a tantalum carbide, Carbonization niobium, a tungsten carbide, a chromium carbide, carbonization molybdenum, calcium carbide, Various carbide, such as a diamond carbon lactam, boron nitride, a titanium nitride, Various borides, such as various nitrides, such as a zirconium nitride, and a zirconium boride, Titanium oxide, a calcium oxide, a magnesium oxide, a zinc oxide, a copper oxide, Various oxides, such as an aluminum oxide, a silica, and colloidal silica, titanic-acid calcium, Various titanic-acid compounds, such as titanic-acid magnesium and a strontium titanate, Various fluorides, such as various sulfides [ , such as molybdenum disulfide ] and magnesium fluoride, carbon, etc. fluoride, independent in various nonmagnetic inorganic particles, such as various metallic soaps, such as an aluminum stearate, a calcium stearate, a zinc stearate, and a magnesium stearate, talc, and a bentonite, -- or it can combine and use

[0044] As an organic particle, particles, such as the styrene system which corned for the purpose, such as a cleaning assistant, by wet polymerization methods, such as an emulsion-polymerization method, a soap free emulsion-polymerization method, and a non-moisture powder polymerization method, the gaseous-phase method, etc., acrylic (meta), benzoguanamine, a melamine, Teflon (registered trademark), silicon, polyethylene, and polypropylene, can be used.

[0045] As for a non-subtlety particle especially a silica, titanium oxide, an alumina, a zinc oxide, etc., it is desirable that surface treatment is carried out by the well-known method from a viewpoint of heat-resistant storage nature and environmental-proof stability using processing agents which have the hydrophobing processing agent currently used from the former, such as a silane coupling agent, a titanate system coupling agent, a silicone oil, and a silicone varnish, a fluorine system silane coupling agent, a fluorine system silicone oil, an amino group, and a quarternary-ammonium-salt machine, such as a coupling agent and a denaturation silicone oil.

[0046] the composition of the particle (after-treatment agent) **\*\***(ed) by a Magenta toner, a cyano toner, and the yellow toner outside in this invention -- abbreviation same -- suppose that it is desirable and is the same here -- composition -- " -- it judges for all the after-treatment agents by which that it is [ abbreviation same ]" or "it is the same" were added more than the 0.3 weight section to the toner 100 weight section in each toner -- having -- respectively -- each toner -- setting -- a kind and an amount -- " -- it shall mean that abbreviation same" or the "same" after-treatment agent is added in common what the kind of after-treatment agent includes the chemical formula with which the raw material of a particle is expressed, and primary [ an average of ] particle size, and is meant -- carrying out -- especially -- the kind of after-treatment agent -- abbreviation -- being the same -- a chemical formula with the particle raw material same irrespective of the existence of surface treatment -- it can express -- and -- this -- the first [ an average of ] particle size in each toner of the after-treatment agent expressed with the same chemical formula means that it is within the limits which is **\*\***20% of those averages, respectively moreover, the amount of an after-treatment agent -- abbreviation -- being the same -- the above -- it means that the addition (addition to the toner 100 weight section) in each toner of the after-treatment agent expressed with the same chemical formula is within the limits of **\*\***20% of those averages, respectively Since the development nature and imprint nature of a toner will change for every color of a toner if the composition of an after-treatment agent differs for every color of a toner, it will be necessary to design development conditions etc. for every color of a toner. Being designed similarly is desirable although you may be the Magenta toner of the above [ a black toner ] for low-cost-izing, a cyano toner and a yellow toner, and the toner of a separate installation meter in this invention.

[0047] It is desirable to the toner 100 weight section 0.05 – 5 weight section and to carry out 0.1–3 weight section addition of the above-mentioned particle preferably. The above-mentioned particle may be used combining it two or more sorts, and those total quantities should just be above-mentioned within the limits in that case.

[0048] The carrier which can use the thing better known than before as a carrier for 2 component developers as a carrier used in order to use the above toners as a 2 component developer, for example, consists of magnetic-substance particles, such as iron and a ferrite, the resin coat carrier which comes to cover such a magnetic-substance particle with a resin, or the binder type carrier which comes to distribute the impalpable powder of a magnetic-substance particle in a binding resin can be used. It is desirable from viewpoints, such as toner SUPENTO, to use the resin coat carrier which used the silicone system resin, the copolymerization resin (graft resin) of organopolysiloxane and a vinyl system monomer, or the polyester system resin as a covering resin also in these carriers, and the carrier which the resin which the isocyanate was made to react to the copolymerization resin of organopolysiloxane and a vinyl system monomer, and was obtained especially covered is desirable from a viewpoint of endurance, environmental-proof stability, and SUPENTO-proof nature. The monomer which has substituents, such as a hydroxyl group which has an isocyanate and reactivity as the above-mentioned vinyl system monomer, is used preferably. Moreover, as for the volume mean particle diameter of a carrier, it is preferably desirable from high-definition reservation and a viewpoint of carrier fogging prevention to use a 20–60-micrometer thing 20–100 micrometers.

[0049] Subsequently, the full color image formation method of this invention is explained. The full color image formation method of this invention is characterized by controlling the maximum coating weight to the recorded material of using a developer which was mentioned above and a Magenta toner, a cyano toner, and a yellow toner to a comparatively small value in the well-known full color image formation method.

[0050] The process developed with the developer which formed the latent image on the electrostatic latent-image support (photo conductor), and mentioned this latent image above in detail, And the process imprinted on a recorded material, without minding the toner image

formed on the electrostatic latent-image support through a middle imprint object In the full color image formation method including the toner image which carried out repeatedly for every color of a developer and was imprinted on the recorded material being established the maximum coating weight to the recorded material of a Magenta toner, a cyano toner, and a yellow toner -- respectively -- two or less 5.0 g/m -- desirable -- 2 - 5.0 g/m<sup>2</sup> -- it controls to the value of 3.0 - 4.8 g/m<sup>2</sup> more preferably By using a specific developer in this way in this invention by the specific "maximum coating weight of a toner to a recorded material", it becomes possible to be high-speed and cheap and to offer a high definition full color picture. If the above-mentioned coating weight exceeds 5.0 g/m<sup>2</sup>, since fixing at low temperature will require comparatively high fixing temperature and/or comparatively long time for becoming difficult and attaining sufficient fixing comparatively, improvement in the speed and low-cost-izing of full color image formation cannot be attained simultaneously.

[0051] When using the aforementioned developer above "the maximum coating weight of a toner to a recorded material" in this invention, the complicatedness of the conditioning for every toner at the time of development can be mitigated by making the "maximum coating weight to a recorded material" of a Magenta toner, a cyano toner, and a yellow toner into within the limits of  $\pm 5\%$  of those averages, respectively. That is, it becomes possible to be high-speed and cheap and to offer a high definition full color picture, mitigating the complicatedness of the conditioning for every toner at the time of development. It becomes possible to be high-speed and cheap and to offer a high definition full color picture, without changing the maximum coating weight of a toner to a recorded material for every toner by controlling further in this invention to the same value of above-mentioned [ the maximum coating weight to the recorded material of a Magenta toner, a cyano toner, and a yellow toner ] within the limits.

[0052] It is desirable to control in this invention like [ the maximum coating weight to the recorded material of a black toner ] the maximum coating weight of a Magenta toner, a cyano toner, and a yellow toner. By controlling such, it is because it becomes possible to be high-speed and cheap and to offer a high definition full color picture still more easily. When for that using carbon black as a coloring matter, it is desirable to fully distribute carbon black.

[0053] In this invention, "the maximum coating weight to the recorded material of a toner" is "a peak of the toner which finally appears on a recorded material", and is one of the conditions beforehand set up for every toner in full color image formation equipment.

[0054] "The maximum coating weight to the recorded material of a toner" is determined as a "peak [ of the toner to which development may adhere at an electrostatic latent-image support ] (henceforth photo conductor maximum coating weight)" row depending on "the imprint efficiency (when not using a middle imprint object) from an electrostatic latent-image support to a recorded material", or "the imprint efficiency and the imprint efficiency (when using a middle imprint object) from a middle imprint object to a recorded material" from an electrostatic latent-image support to a middle imprint object The photo conductor maximum coating weight is determined by the potential of the picture section in an electrostatic latent-image support and the potential of the non-picture section, the surface potential of a developer support, the distance of an electrostatic latent-image support and a developer support, the magnetism of a carrier, resistance of a carrier, the amount of conveyances of the developer to a developer support top, the peripheral-speed ratio of a developer support and an electrostatic latent-image support, etc.

[0055] Hereafter, the case where a full color picture is formed using the above-mentioned image formation method is explained briefly. First, the photo conductor (electrostatic latent-image support) of a photo conductor drum is uniformly charged with a primary electrification vessel, the laser beam modulated in the Magenta picture signal of a manuscript performs picture exposure, and an electrostatic latent image is formed on a photoconductor drum. Next, after developing this electrostatic latent image with the Magenta development counter which holds the developer containing a Magenta toner and forming a Magenta toner



image on a photoconductor drum, this Magenta toner image is imprinted to the conveyed recorded material with an imprint electrification vessel. On the other hand, the photo conductor drum after the Magenta toner image was imprinted is discharged with the electrification vessel for electric discharge, and is cleaned by the cleaning means. After developing after that this electrostatic latent image by the developer which contains formation of electrification with the primary electrification machine of a photo conductor drum, and the electrostatic latent image to photo conductor drum lifting by the picture exposure using the cyano picture signal, and a cyano toner again like the formation method of the above-mentioned Magenta toner image, the cyano toner image to the recorded material with which the above-mentioned Magenta toner image is imprinted is imprinted. Furthermore, formation of a yellow toner image and formation of a black toner image are performed like the formation method of the above-mentioned Magenta toner image one by one, and the color toner picture of four colors is imprinted to a recorded material, and it is established by pressurization and heating according the imprinted full color picture to a fixing roller etc.

[0056] Even if it changes the formation sequence of each color picture, there is especially no problem. Moreover, in the above-mentioned explanation, although the composition which imprints each color toner picture one by one directly to a recorded material was shown, after piling up each color toner picture to middle imprint objects, such as a middle imprint belt, and imprinting one by one to them, you may imprint a superposition picture to a recorded material collectively.

[0057] The full color image formation method of this invention is faced actually carrying out. Since the sensitivity of a photo conductor and the electrification property of a developer may be changed and "the photo conductor maximum coating weight (maximum coating weight to the recorded material of a toner)" may be changed with change of the operating environments (temperature, humidity, etc.) of the equipment which adopted the method concerned, It is desirable to perform automatic concentration control (automatic control of the photo conductor maximum coating weight) about each of the toner of a color with which plurality differs periodically.

[0058] forming a criteria toner image (solid picture) on an electrostatic latent-image support according to predetermined development conditions, and changing suitably strange good development conditions, such as potential of the picture section in an electrostatic latent-image support and potential of the non-picture section, and surface potential of a developer support, with automatic concentration control, based on the coating weight of this criteria toner image -- the value of a convention of the photo conductor maximum coating weight -- an amendment -- they are things

[0059] While a desirable mode smell performs the above-mentioned automatic concentration control, measures the surface potential of the electrostatic latent-image support charged on condition that predetermined by the surface potential measurement means for every fixed period and makes a storage means memorize the measured value The last measured value memorized by this measured value and the storage means is compared, when the amount of change is larger than a predetermined value, the aforementioned automatic concentration control is performed, and in being smaller than a predetermined value, it controls to maintain the last development conditions, without performing the aforementioned automatic concentration control. Although the latency time for dozens of seconds will occur by the time the picture of the 1st sheet outputs when performing automatic concentration control, if control according to the amount of change of the surface potential of the above electrostatic latent-image supports is performed, since automatic concentration control with a comparatively small effect will no longer be performed and the number of times of execution of automatic concentration control will be effectively reduced as a result, working capacity improves.

[0060] The 1st mode in which form a criteria toner image about each of the toner of a color with which plurality differs according to the amount of change of the surface potential of the

aforementioned electrostatic latent-image support, and development conditions are set up in another desirable mode in case automatic concentration control is performed, A criteria toner image is formed only about the predetermined color of the toners of a color with which plurality differs, development conditions are set up, and the 2nd mode in which the development conditions of other colors are set up is chosen based on the development conditions of this predetermined color. If selection based on the amount of change of the surface potential of such an electrostatic latent-image support is performed, since [ which not necessarily performs automatic concentration control about the toner of all colors / being required ] it is lost and the number of times of execution of automatic concentration control is effectively reduced as a result, working capacity will improve.

[0061] In the method of this invention, aiming at further improvement in working efficiency by adopting combining the two above-mentioned desirable modes, over a long period of time, it is high-speed and cheap and a high definition full color picture can be offered.

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JAPANESE

[JP,2002-131973,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE  
INVENTION TECHNICAL PROBLEM MEANS EXAMPLE

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[Translation done.]

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3.In the drawings, any words are not translated.

## EXAMPLE

[Example] (Manufacture of a binder resin (polyester resin)) The alcoholic component and the acid component were put into the four glass mouth flask furnished with the thermometer, the stirrer, the flowing-down formula capacitor, and the nitrogen introduction pipe with the polymerization initiator (dibutyl tin oxide) by the mole ratio shown in Table 1. It was made to react, agitating this at 220 degrees C under nitrogen-gas-atmosphere mind in a mantle heater, and polyester resin A1 and A2 was obtained. The obtained polyester resin had physical properties as shown in Table 1. In addition, EO is front Naka and PO is a polyoxyethylene (2 2) about polyoxypropylene (2 2) -2 and 2-screw (4-hydroxyphenyl) propane. - TPA expresses a terephthalic acid and FA expresses a fumaric acid for 2 and 2-screw (4-hydroxyphenyl) propane.

[0063]

[Table 1]

ポリエステル 樹脂	アルコール成分		酸成分		Mn	Mw/Mn	Tg (℃)	Tm (℃)	酸価 (KOHmg/g)	水酸価 (KOHmg/g)	粉碎性 指数
	PO	EO	FA	TPA							
A1	1.0	10.0	7.0	2.0	3500	3.6	55.4	98.0	4.8	29.1	2.2
A2	10.0	1.0	—	9.0	3900	3.8	64.5	100.2	3.8	27.4	1.8

[0064] (Manufacture of a polymer (B))

- 1.5g of BF<sub>3</sub>-phenol complexes was dropped in [ small quantity / every ] about 10 minutes, having taught resin B1 styrene (99.9% of purity) 150g, and toluene 150g to the autoclave, and keeping temperature at 5 degrees C under stirring. Then, stirring was continued for further 3 hours. Next, after rinsing until it separated the water layer and became neutral about polymerized oil further, after having added 50ml of sodium-hydroxide solution 5%, stirring violently for 30 minutes and decomposing a catalyst, an unreacted oil and solvent toluene were distilled off and polystyrene 120g was obtained as a residue. The polymer concerned was used as the resin B1, and physical properties were shown in Table 2.

[0065] - 1.5g of BF<sub>3</sub>-phenol complexes was dropped in [ small quantity / every ] about 10 minutes, having taught 150g / of resin B-2 alpha methyl styrenes / (99.8% of purity), and toluene 150g to the autoclave, and keeping temperature at 5 degrees C under stirring. Then, stirring was continued for further 3 hours. Next, after rinsing until it separated the water layer and became neutral about polymerized oil further, after having added 50ml of sodium-hydroxide solution 5%, stirring violently for 30 minutes and decomposing a catalyst, an unreacted oil and solvent toluene were distilled off and 120g of Polly alpha methyl styrenes was obtained as a residue. The polymer concerned was made into resin B-2, and physical properties were shown in Table 2.

[0066] – 250g [ of resin B3 alpha methyl styrenes ] (99.8% of purity) and isopropenyl toluene 250g and toluene 500g are put into a three-neck flask, and a 3 fluorine boron phenol complex is added small quantity every under churning, and it was made to react at 20 degrees C for 3 hours, cooling by the dry ice acetone bath. Subsequently, added alkali, the catalyst was made to deactivate and it removed, it condensed in order to drive out a solvent and an unreacted monomer, and the alpha-methyl-styrene-isopropenyl toluene copolymer was obtained as a residue. The polymer concerned was used as the resin B3, and physical properties were shown in Table 2.

[0067] – Resin B4 isopropenyl toluene (98% of purity) 200g, 200g [ of alpha methyl styrenes ] (98% of purity), 120g [ of C5 system petroleum fractions obtained by the pyrolysis of petroleum naphtha ] (isoprene), and toluene 500g is put into a three-neck flask, and a 3 fluorine boron phenol complex is added small quantity every under churning, and it was made to react for 3 hours, cooling by the dry ice acetone bath. Next, after having added NaOH solution, agitating violently and decomposing a catalyst, the aqueous phase was separated and the oily polymerization object was obtained. After rinsing a still more nearly oily polymerization object until it became neutral, heating reduced pressure distilling off of an unreacted oil and the solvent was carried out, and the massive white alpha-methyl-styrene-isopropenyl toluene-isoprene copolymer as a residue was obtained. The polymer concerned was used as the resin B4, and physical properties were shown in Table 2.

[0068] – Polystyrene was obtained by the same process as a resin B1 except having made resin B5 reaction time into 2 hours. The polymer concerned was made into resin B5 and physical properties were shown in Table 2.

– The Polly alpha methyl styrene was obtained by the same process as resin B-2 except having made resin B6 reaction time into 4.5 hours. The polymer concerned was made into resin B6 and physical properties were shown in Table 2.

[0069]

[Table 2]

重合体 (B)		Mw	Mn	Mw/Mn	Tg (°C)	粉碎性 指数
B1	ポリスチレン	1500	1000	1.5	62	0.3
B2	ポリ-α-メチルスチレン	2800	1500	1.9	75	0.5
B3	α-メチルスチレン-イソプレネール トルエン共重合体	2400	1500	1.6	72	0.5
B4	α-メチルスチレン-イソプレネール トルエン-イソプレネール共重合体	1900	1100	1.7	65	0.3
B5	ポリスチレン	900	650	1.4	40	0.2
B6	ポリ-α-メチルスチレン	3100	1700	1.8	88	0.7

[0070] (Manufacture of a pigment masterbatch) The pigment used for manufacture of a full color toner was used as a pigment masterbatch obtained by the following methods. The binder resin and pigment which are used in each example or the example of comparison were taught to the pressurized kneader at a rate of the weight ratio (resin : pigment) 7:3, and it kneaded at 120 degrees C for 1 hour. Coarse grinding was carried out with the hammer mill after cooling, and the pigment masterbatch of 30 % of the weight of pigment content was obtained. As a pigment, C.I.Pigment Yellow180 (Hoechst A.G. make), C.I.Pigment Blue 15-3 (Dainippon Ink make), and C.I.Pigment Red 57-1 (Dainippon Ink make) were used.

[0071] After having used toner M1 polyester resin A1 and the pigment masterbatch so that it might become the polyester resin A1;100 weight section and C.I.Pigment Red57-1;5 weight

section, carrying out 10 weight sections addition of the resin B1 at this and mixing by the Henschel mixer, melting kneading was carried out by the extruder. coarse grinding after cooling the obtained kneading object — and it pulverized and the trituration object of 5.5 micrometers of volume mean particle diameters was obtained Then, the trituration object was classified and the toner particle of 6 micrometers of volume mean particle diameters was obtained. After adding the hydrophobic silica (H2000; Hoechst A.G. make) 0.9 weight section, the hydrophobic titanium oxide (particle size of 50nm) 0.9 weight section, and the strontium-titanate (particle-size [ of 350nm ], BET specific surface area 9m<sup>2</sup>/g) 2.0 weight section and carrying out mixed processing by the Henschel mixer to this toner particle 100 weight section, the Magenta toner (M1) was obtained.

[0072] The toner Y1 and C1 pigment masterbatch were changed, and toners Y1 and C1 were obtained by the same process as a toner M1 except having used polyester resin A1 and the pigment masterbatch so that it might become the polyester resin A1;100 weight section and C.I.Pigment Yellow180;8.5 weight section or polyester resin A1;100 weight section, and C.I.Pigment Blue15-3;7 weight section.

[0073] The toner K1 pigment masterbatch was changed into carbon black (mho gal L;pHby Cabot Corp. 2.5; primary [ an average of ] particle size of 24nm), and the toner K1 was obtained by the same process as a toner M1 except having used polyester resin A1 and carbon black so that it might become the polyester resin A1;100 weight section and the carbon black;8 weight section.

[0074] Toners M2-M12 were obtained by the same process as a toner M1 except having used the pigment masterbatch for the binder resin shown in toner M2 – M12 Table 3 – 5, and the polymer (B) row so that it might become the written toner composition. Toners Y2-Y12 were obtained by the same process as a toner Y1 except having used the pigment masterbatch for the binder resin shown in toner Y2 – Y12 Table 3 – 5, and the polymer (B) row so that it might become the written toner composition.

[0075] Toners C2-C12 were obtained by the same process as a toner C1 except having used the pigment masterbatch for the binder resin shown in toner C2 – C12 Table 3 – 5, and the polymer (B) row so that it might become the written toner composition.

Toners K2-K12 were obtained by the same process as a toner K1 except having used carbon black for the binder resin shown in toner K2 – K12 Table 3 – 5, and the polymer (B) row so that it might become the written toner composition.

[0076] It used combining the toner shown in Table 3 – 5, and an example and example of comparison each example, or the example of comparison estimated the following items.

[0077] (Productivity) When a mechanical grinder (KTM-0 type : Kawasaki Heavy Industries, Ltd. make) ground a sample (toner constituent (what carried out 2mm mesh path with the feather mill after kneading cooling)) at Throughput F (5 kg/h) and the KTM rotational frequency 12000 (rpm), the load power value W1 when passing the load power value W0 and sample at the time of sample passage nothing was recorded. Then, the volume mean particle diameter D of the trituration object obtained by KTM trituration (micrometer) was measured by the multi-sizer II (made in coal tar Beckmann). The grindability index was computed based on the following formula, and it evaluated according to the following ranks. In addition, evaluation was performed about each toner and the average was shown.

Grindability index (H) =  $(D \times (W1 - W0)) / F$  [0078]

O;  $1.0 \leq H < 1.5$ ;

O;  $0.5 \leq H < 1.0$  or  $1.5 \leq H < 2.0$ ;

x;  $H < 0.5$  (too soft) or  $2.0 \leq H$  (too hard).

[0079] (Heat-resistant storage nature) After leaving toner 10g under the elevated temperature of 50 degrees C for 24 hours, the state of aggregation of a toner was observed visually. In addition, evaluation was performed about each toner and the worst result was shown.

O : the aggregate was not seen at all.;



O : although the aggregate existed, it got loose with the weak shock.;

x: The aggregate existed and it did not get loose easily.

[0080] (Electrification nature) The amount of electrifications of each toner was measured by the electric-field separation method. The average was calculated from the amount of electrifications of a Magenta toner, a yellow toner, a cyano toner, and a black toner. The difference of the amount of electrifications of each toner and the average concerned was searched for, and the rate (X (%)) of the difference concerned over the average was searched for. The rate concerned was evaluated according to the following ranks. In addition, evaluation was performed about each toner and the worst result was shown. The carrier used the acrylic denaturation silicone coat ferrite carrier.

O;  $-5 \leq X \leq 5$  (%);

O;  $-10 \leq X < -5$ (%) or  $5 < X \leq 10$  (%);

x;  $X < -10$ (%) or  $10 < X$  (%).

[0081] the following evaluations -- a toner -- an acrylic denaturation silicone coat ferrite carrier and a toner -- 2 component developer prepared and obtained so that a mixing ratio might become 5% of the weight was used

[0082] (Graininess) A Magenta, yellow, cyanogen, and 2 component developer of black were carried in the digital full color copying machine (CF910; Minolta Camera Co., Ltd. make) with which the toner maximum coating weight was set as the value shown in Table 3 - 5, and Society of Electrophotography of Japan chart 1995 No 5-1 was copied.

O; it was better than the graininess of the present product.;

x; it was inferior to the graininess of the present product.

[0083] (Low-temperature fixing nature) A Magenta, yellow, cyanogen, and 2 component developer of black are carried in the digital full color copying machine (CF910; Minolta Camera Co., Ltd. make) with which the maximum coating weight of each toner was set as the value shown in Table 3 - 5, and fixing temperature is set in the range of 120 degrees C - 170 degrees C. 1.5cmx1.5cm 3 color superposition picture (a Magenta toner, a yellow toner, and cyano toner) was printed making it change by 2-degree-C serration. The picture was bent from middle to two and viewing estimated the detachability of the picture. Temperature between the fixing temperature when a picture bending and exfoliating to the section circumference and fixing temperature when a picture bends and only the section exfoliates was made into fixing minimum temperature.

O; fixing minimum temperature was less than 145 degrees C.;

O; fixing minimum temperature was 145 degrees C or more less than 155 degrees C.;

\*\*; fixing minimum temperature was 155 degrees C or more less than 165 degrees C.;

(practically with no problem)

x; fixing minimum temperature was 165 degrees C or more (practically those with a problem).

[0084]

[Table 3]

	粒径 ( $\mu\text{m}$ )	トナー組成			付着量 ( $\text{g}/\text{m}^2$ )	評価				
		バインダー 樹脂	重合体(B) 種/部*	着色剤** 使用量(部)		生産性	耐熱 保管性	粒状性	帯電性	低温 定着性
実施例1	トナーM1	A1	B1/10	5	4.5	◎	○	○	◎	◎
	トナーY1	A1	B1/10	8.5						
	トナーC1	A1	B1/10	7						
	トナーK1	A1	B1/10	8						
実施例2	トナーM2	A1	B2/10	5	4.5	◎	◎	○	◎	○
	トナーY2	A1	B2/10	8.5						
	トナーC2	A1	B2/10	7						
	トナーK2	A1	B2/10	8						
実施例3	トナーM3	A1	B3/10	5	4.5	◎	◎	○	○	○
	トナーY3	A1	B3/10	8.5						
	トナーC3	A1	B3/10	7						
	トナーK3	A1	B3/10	8						
実施例4	トナーM4	A1	B4/10	5	4.5	◎	○	○	○	◎
	トナーY4	A1	B4/10	8.5						
	トナーC4	A1	B4/10	7						
	トナーK4	A1	B4/10	8						
実施例5	トナーM5	A1	B1/5	5	4.5	○	○	○	○	◎
	トナーY5	A1	B1/5	8.5						
	トナーC5	A1	B1/5	7						
	トナーK5	A1	B1/5	8						

\*バインダー樹脂100重量部に対する重合体 (B) の使用量を示す。

\*\*バインダー樹脂100重量部に対する着色剤の使用量を示す。

[0085]

[Table 4]

	粒径 ( $\mu\text{m}$ )	トナー組成			付着量 ( $\text{g}/\text{m}^2$ )	評価				
		バインダー 樹脂	重合体(B) 種/部*	着色剤** 使用量(部)		生産性	耐熱 保管性	粒状性	帯電性	低温 定着性
実施例6	トナ-M6	A1	B1/10	6.5	3.5	◎	○	○	○	◎
	トナ-Y6	A1	B1/10	11						
	トナ-C6	A1	B1/10	9						
	トナ-K6	A1	B1/10	8						
実施例7	トナ-M7	A2	B1/10	5	4.5	◎	○	○	◎	△
	トナ-Y7	A2	B1/10	8.5						
	トナ-C7	A2	B1/10	7						
	トナ-K7	A2	B1/10	8						
比較例1	トナ-M8	A1	-/0	5	4.5	×	×	○	×	○
	トナ-Y8	A1	-/0	8.5						
	トナ-C8	A1	-/0	7						
	トナ-K8	A1	-/0	8						
比較例2	トナ-M9	A1	B1/25	5	4.5	×	○	○	◎	○
	トナ-Y9	A1	B1/25	8.5						
	トナ-C9	A1	B1/25	7						
	トナ-K9	A1	B1/25	8						
比較例3	トナ-M10	A1	B1/10	3.5	7	◎	○	×	◎	△
	トナ-Y10	A1	B1/10	6						
	トナ-C10	A1	B1/10	5.3						
	トナ-K10	A1	B1/10	8						

\*バインダー樹脂100重量部に対する重合体 (B) の使用量を示す。

\*\*バインダー樹脂100重量部に対する着色剤の使用量を示す。

[0086]

[Table 5]

	粒径 ( $\mu\text{m}$ )	トナー組成			付着量 ( $\text{g}/\text{m}^2$ )	評価					
		バインダー 樹脂	重合体(B) 種/部*	着色剤** 使用量(部)		生産性	耐熱 保管性	粒状性	帯電性	低温 定着性	
比較例4	トナ-M11	6	A1	B5/10	5	4.5	◎	×	○	×	◎
	トナ-Y11	6	A1	B5/10	8.5						
	トナ-C11	6	A1	B5/10	7						
	トナ-K11	6	A1	B5/10	8						
比較例5	トナ-M12	6	A1	B6/10	5	4.5	○	◎	○	×	△
	トナ-Y12	6	A1	B6/10	8.5						
	トナ-C12	6	A1	B6/10	7						
	トナ-K12	6	A1	B6/10	8						

\*バインダー樹脂100重量部に対する重合体 (B) の使用量を示す。

\*\*バインダー樹脂100重量部に対する着色剤の使用量を示す。

[0087] (Manufacture of an acrylic denaturation silicone coat ferrite) It is 100 weight \*\*\*\*\* about a methyl ethyl ketone at a flask with an equipped with a stirrer, a capacitor, a thermometer, a nitrogen introduction pipe, and dropping equipment capacity of 500ml. Under nitrogen-gas-atmosphere mind, at 80 degrees C, the solution which was made to dissolve the methyl methacrylate 86.7 weight section, 2-hydroxyethyl methacrylate 5.1 weight section, 3-methacryloxypropyl tris (trimethylsiloxy) silane 58.2 weight section and 1, and 1'-azobis (cyclohexane-1-carbonitrile) 1 weight section in the methyl-ethyl-ketone 100 weight section, and was obtained was dropped into the reactor over 2 hours, and was ripened for 5 hours. after

- adjusting isophorone diisocyanate / trimethylol-propane adduct (IPDI/TMP system : NCO%= 6.1%) as a cross linking agent to the obtained resin so that the OH/NCO mole fraction may become 1/1 -- a methyl ethyl ketone -- diluting -- a fixed ratio -- the coat resin solution which is 8 % of the weight was prepared  
[0088] Using the baking ferrite powder F-800 (volume mean particle diameter : micrometers [ 50 ], Powdertech make) as core material, the above-mentioned coat resin solution was applied and dried with Spira Cota (Okada elaborate company make) so that the amount of covering resins to core material might become 1.5% of the weight. In hot blast circulating oven, at 160 degrees C, the obtained carrier was left for 1 hour and calcinated. The ferrite powder bulk after cooling was cracked using the sieve shaker which attached 106 micrometers of openings, and a 75-micrometer screen mesh, and the acrylic denaturation silicone coat ferrite carrier was obtained.  
[0089] (others -- measuring method)
  - Temperature which flows out of the defluxion start point when carrying out melting defluxion of the sample of 3 1cm on condition that the pore (the path of 1mm, a length of 1mm) of a dice, pressurization 30 kg/cm<sup>2</sup>, and 3 degrees C of programming rates and min using the measuring method flow tester (CFT-500:Shimadzu Corp. make) of the softening temperature T<sub>m</sub> of a resin, and is equivalent to one half of the height of an ending point was made into softening temperature.
  - The acid number is the value which dissolved the 10mg sample in toluene 50ml, titrated using the mixed indicator of 0.1% of bromthymol blue, and a Phenol Red with N / 10 potassium hydroxides / alcoholic solution by which standardization was carried out beforehand, and was computed from the consumption of N / 10 potassium hydroxides / alcoholic solution.  
[0090] - The particle size of a toner was measured using the coal tar multi-sizer II.
  - The mean particle diameter of an inorganic particle was observed with the transmission electron microscope (JEM-1010 type; the JEOL datum company make), measured the diameter of 100 particles, and asked for the mean particle diameter.

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[Translation done.]

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[Translation done.]

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Sughrue

SUGHRUE MION, PLLC

MAIL STOP PATENT APPLICATION

Q79234

Page 2

Priority is claimed from:

<u>Country</u>	<u>Application No</u>	<u>Filing Date</u>
Japan	2003-002223	January 8, 2003
Japan	2003-007288	January 15, 2003
Japan	2003-433363	December 26, 2003

The priority documents will be filed at a later date.

Respectfully submitted,  
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January 5, 2004

## MAIL STOP PATENT APPLICATION

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Re: Application of Nobuhiro MIYAKAWA, Shinji YASUKAWA, Mikio  
FURUMIZU, Nobumasa ABE, Masanao KUNUGI, and Yoshiro KOGA  
IMAGING SYSTEM  
**Assignee: SEIKO EPSON CORPORATION**  
Our Ref. Q79234

Dear Sir:

Attached hereto is the application identified above comprising ninety-three (93) sheets of the specification, including the claims and abstract and eight (8) sheets of drawings. **The requisite US Government Filing Fee, executed Declaration and Power of Attorney and Assignment will be submitted at a later date.** Also enclosed is an Information Disclosure Statement and PTO/SB/08 A & B (modified).

The Government filing fee is calculated as follows:

Total claims	<u>16 - 20</u>	= _____ x \$18.00 =	\$_____.00
Independent claims	<u>2 - 3</u>	= _____ x \$86.00 =	\$_____.00
Base Fee			<u>\$770.00</u>
Multiple Dependent Claim Fee			<u>\$290.00</u>
<b>TOTAL FEE</b>			<b>\$1060.00</b>